The Chemical Age

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NOTICES:—All communications relating to editorial matter should be addressed to the Editor, who will be pleased to consider articles or contributions dealing with modern chemical developments or suggestions bearing upon the advancement of the chemical industry in this country. Communications relating to advertisements or general matters should be addressed to the Manager.

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A Monumental Report

As a model of comprehensiveness it would be difficult to surpass the official report, covering a hundred or so printed pages, which the United States Secretary of Agriculture presented before Congress towards the end of last month. The greater part of the report deals with the prevailing state and the future outlook of the different branches of agriculture, but there are references to fertilisers, and particularly synthetic substances, which disclose a certain number of facts which were probably unknown to the majority in this country. Perhaps, for instance, the most striking recognition of the work of the Fixed Nitrogen Laboratory during the past year was the adoption of the Laboratory's own synthetic ammonia process by an American company. The name of the company is not mentioned in the report, but there can be little doubt that the Mathieson Alkali Co. is referred to, and it is of considerable interest to hear that the plant was put into operation during the past spring and that it has proved unusually successful. The process is regarded as a triumph and outstanding example of research work which has extended over several years, and its successful operation within so short a time of its completion certainly speaks well for the soundness of its design. Unfortunately, no very detailed information of the technical results or principles of the plant are given, but it is learned that the pressure employed is 300 atmospheres, and that the output is three tons of ammonia per day. In America, apparently, the process, with its various improvements, is regarded as a considerable step in advance of the Haber process, and it will be interesting to watch developments and, after further experience, to hear results of its working and the opinion of American chemical engineers as to its merits compared with the systems of Claude and Casale which are already in operation, or nearing a stage of completion, in that country.

As regards the marketing of fertilisers, the Fixed Nitrogen Laboratory, in realisation of the difficulties which will be encountered in the direct introduction of concentrated forms of nitrogen into the fertiliser industry, has been co-operating with the other official bureaux with the object of preparing the way, on the one hand, for stimulating the use of concentrated fertilisers from the agricultural standpoint, and on the other, of giving the farmer the advantage of such use through obtaining proper freight rates on the concentrated products. This will mean a reduction in the cost of shipping the smaller tonnage of the concentrated material. There are many other important points raised in the report, and it is to be noted that a thorough survey is to be made of the possibilities of recovering cyanides from blast furnace gases, another development the progress of which will be followed with keen interest.

The Design of High-Pressure Joints

As an example of the attention demanded by details in plant utilised for the production of synthetic ammonia may be mentioned the problem of designing suitable joints for the very high pressures involved. The increasingly high pressures utilised in ammonia synthesis have, as the report alluded to above rightly points out, developed a pressing need in high-pressure engineering for suitable gaskets capable of withstanding the enormous pressures to which the plant is subjected. The old principle of gasket design for high pressures was to make them broader the higher the pressure to be resisted, on the theory that the greater the area of contact the greater would be the resistance. The falsity of this was recognised in the Fixed Nitrogen Laboratory when it was realised that by distributing the pressure that could be applied to the gaskets over too great a gasket area, the pressure per unit area would thus be reduced below the pressure of gas to be withstood, and consequently blow-outs would inevitably result.

This eventually led to an entirely new principle, which depends upon designing the gasket area in such a way that it is reduced exactly to comply with the conditions of use, with the result that noteworthy improve-

ment has been effected, and the new system has been eagerly adopted by the ammonia industry. Another direction in which improvement in design was called for was in connection with high-pressure relief valves. It is, therefore, gratifying to learn that the laboratory has succeeded in developing an automatic continually operating relief valve which has overcome all the drawbacks of those formerly in general use. This new valve is by no means restricted in its use to nitrogen fixation processes, but is suitable for all purposes where high pressures are involved, and it appears to have been most favourably received by various industries in America. In this country too little attention has been given to this important problem of high pressures and atmospheres, and possibly the lack may be presently made up by investigations which it is understood are contemplated at the new Chemical Research Laboratory at Teddington under the direction of Professor Morgan.

A New British Industry

WE recently quoted from Mr. J. R. Cahill's official report on the "Economic and Industrial Conditions in France" a reference to the growth of trade in the relatively new rapidly maturing cement known as "Ciment Fondu," and an announcement that for the purpose of meeting the demands of the British markets the manufacturers were erecting works in England. In London last week an interesting account of these new works, which are being established on the Thames at West Thurrock, Essex, was given by one of the directors, Mr. J. G. Kay. The point in favour of the new cement is that so rapidly does it harden that the heaviest traffic can pass over it 24 hours after it is laid. In addition, it has the important property of resisting the destructive effects of sea water and other sulphur-impregnated liquids which in course of time cause the older forms of cement to decompose. Although the main use at present contemplated is in connection with road construction, the new cement promises to find a large field in building construction, where its increased strength will enable concrete buildings to be designed in a less massive and ponderous style.

From January 1 of this year "Ciment Fondu," we understand, became a British product. The works are equipped with the most modern machinery and the expenditure on them has already reached £130,000, all spent on British plant. They are designed for an eventual output of 150,000 tons per year and plant to produce 40,000 tons is at present in operation. The method of manufacture, as briefly explained by Mr. Kay, differs completely from the old clinkerisation process. The new cement is made by smelting chalk or limestone and bauxite in a kind of blast furnace. The material pours out in a molten state like molten metal. It is cast into pigs, which are subsequently broken up. These broken pieces are ground into a very fine powder, which constitutes the cement. The material is elevated into silos and bagged mechanically. All the raw materials for its manufacture except one are readily available in this country. The exception, bauxite or aluminium ore, alone has to be imported. This is mined to-day in France and Italy, but deposits have been found in certain British colonies, where the company propose to go for their requirements as soon as the supply is commercially available.

Naturally, the commercial production of "Ciment Fondu" has been preceded by exhaustive chemical research and physical experiment, and chemistry continues to play an essential part in its production. An important section of the works is the laboratory, where the quality of the cement is under continual control. Tests and experiments are also carried out on behalf of customers. As chemistry has helped to produce the new material, so chemical industry should find many uses for a cement which, in addition to setting quickly, has a high power of resistance to corrosive effects. The Lafarge Co. will no doubt see to it that the industry is properly instructed in the merits of their product.

Electrical Power for Hydrogen

THE question of the production of hydrogen by the electrolytic method, of which much has been heard of late, has again been raised in connection with the Government's new electricity proposals. The latter contemplate the establishment of very large generating stations throughout the country, and the familiar problem in large scale generating plant is the economic utilisation of "off-peak" power. Dr. J. F. Crowley, formerly associated with the late Dr. Harker, of the Nitrogen Products Committee, has already pointed out, in a statement on the Government scheme, the large opening for electrical power in the production of hydrogen for use in the synthesis of ammonia. A Canadian Government Committee which recently investigated the "off-peak" problem came to the conclusion that the production of oxygen by electrolytic means furnished the best solution. Oxygen is already largely used in industry, and many new applications are at present under investigation. It must be remembered that research workers like Dr. Cottrell have dreams at least of some day finding a method of producing oxygen so cheaply as to effect an industrial revolution almost comparable to that resulting from the introduction of steam. Dr. Crowley's concern for the moment, however, is to point out that in the synthetic ammonia industry there is a definite and already large market for hydrogen, and that the electrolytic production of this gas deserves consideration as a factor in the utilisation of "off-peak" electrical power. He points out that before and during the war the synthetic ammonia plants controlled by Germany were of a size that only permitted economic production on a very large scale. The large unit still appears to be a characteristic of the Haber process, but since the war, Dr. Crowley reminds us, new processes have been developed and are now in commercial operation, with hydrogen produced electrolytically, on a scale as small as from 3 to 7½ tons of ammonia per day. He is no doubt referring to the Casale method, respecting which some particulars were given when Dr. Casale visited this country some time ago in connection with proposals for introducing his method in this country. Here is one side on which the new proposals may definitely affect the chemical industry.

On another side, no doubt, the Government scheme is being very carefully examined by authorities in the gas industry. Already the returns from the by-

products of coal gasification show signs of restriction, and if the supply of electricity is both enlarged and cheapened to the extent which supporters of the Government scheme suggest, the competition with gas must necessarily be strengthened. If, in addition, the electricity development plans are to be supported by Government financial guarantees under the Trades' Facilities Act or in any other form—which means ultimately guaranteeing the interest on loans by investors—one can understand the gas industry asking if this is quite fair towards concerns equally engaged in manufacturing public utility products under stringent public obligations. It is early yet to discuss this aspect in detail, but it may be assumed that gas interests are fully alive to the situation that may develop.

From College to Works

The very young chemist who emerges from school or college with the idea that his mission in life is to teach the mere technologist his business would be well advised to avoid Sir William Pope, if one may judge from a discerning introductory note the latter has written for Dr. S. I. Levy's new volume on "Industrial Chemistry" (G. Bell and Sons). When the student leaves his academic studies for a career in chemical works he has had, as Sir William points out, little if any opportunity of becoming acquainted with the rapid industrialisation of laboratory ideas. "Throughout his training, he and his comrades have been the staple article of production of his school; his teachers have spared no effort to develop such natural talents as he may possess, and to equip him with a competent knowledge of chemistry and the allied sciences."

When, however, he enters a chemical works he enters entirely new conditions. The junior addition to the staff finds himself in a position which, though modest, carries certain very definite responsibilities foreign to those attaching to a student in an academic laboratory. He should soon realise, provided the concern is conceived on modern principles, that his emoluments and the rapidity of his promotion are directly proportional to his own contribution to the success of the undertaking; chemical works are run on a costing system which precludes payment for services which are not rendered. He has to learn that by cordial co-operation between many individuals differing in tastes and duties, directed towards economy of production and elimination of waste, the enterprise as a whole achieves success. Such novel surroundings may appear at first unfamiliar; if finally they prove uncongenial the sufferer must look for the cause in his own personality and his own outlook. This is sound advice, and though apparently blunt the novice will find it in the end to be kindly advice also.

Equally sound, as we might well expect, is Sir William Pope's theory as to the academic training that should precede works practice. The soundest college training, he suggests, for an industrial chemist is probably one in which all technological questions are ignored until the student has acquired a complete mastery of the great scientific principles underlying modern chemistry. The college or university must confine itself to imparting a broad and secure knowledge of chemical science, leaving to the harder school of the chemical works the task of teaching the young technologist what is and what is not possible in an industrial process. It was once said that chemical technology consisted in substituting for the glass beakers of the laboratory the iron pots and wooden vats of the works. This, as Sir William points out, was probably never really true, and is certainly not true to-day. The chemistry of works operations is the chemistry of the scientific laboratory, but under very different conditions. While in the laboratory heating and cooling during experimental work are so readily controlled by the operator that other than routine precautions become unnecessary, the factory handling of large heat exchanges calls for the device of the most efficient automatic control and for the most minute adjustment. These points, though clear enough to the mature observer, are only too apt to be overlooked by over-confident youth and inexperience, and it is well to find high academical authorities like Sir William Pope recognising and even insisting on the importance of the technological and practical side.

Books Received

Allen's Commercial Organic Analysis, Vol. IV. Edited by S. S. Sadtler, E. C. Lathrop and C. Ainsworth Mitchell. London: J. and A. Churchill. Pp. 648. 30s.

Industrial Fermentations. By Paul W. Allen. London: The Chemical Catalog Co. Inc. Pp. 424. $5.00.

The Basis of Modern Atomic Theory. By C. H. Douglas Clark. London: Methuen and Co., Ltd. Pp. 292. 8s. 6d.

The Calendar

Jan.		
25	Chemical Industry Club: "Recent Developments in Surface Combustion." Major T. G. Tulloch. 8 p.m.	2, Whitehall Court, London, S.W.1.
25	Birkbeck College (University of London) Chemical Society: "New Physical Foundations for Old Chemical Beliefs." Professor T. M. Lowry. 6 p.m.	Birkbeck College, London, E.C.4.
25	Birmingham Universal Chemical Society: "The Relation of Chemical Constitution to Physiological Properties." Professor J. B. Cohen.	Birmingham.
26	Northern Polytechnic Chemical Association: "The Man in the Works." Charles S. Roy. 8 p.m.	Holloway, London.
26	Royal Institution: "X-Rays and Living Matter." James A. Crowther. 5.15 p.m.	21, Albemarle Street, London.
27	Institute of Metals (Birmingham): "Metallurgy of Nickel with Special Reference to Work in Canada." W. R. Barclay. 7 p.m.	Temperance Hall, Temple Street, Birmingham.
27	Institute of Chemistry (Belfast Section): "The Chemistry of Pectins." Dr. A. E. Cashmore. 7.30 p.m.	Queen's University, Belfast.
27	Institute of Chemistry (Edinburgh Section): "Recent Developments in the Refining of Petroleum." Dr. A. E. Dunstan. 7.30 p.m.	36, York Place, Edinburgh.
27	Society of Chemical Industry (Nottingham Section): Discussion on "Costing in Chemical Factories." Mr. H. Calam. 7.30 p.m.	University College, Nottingham.
28	Institute of Chemistry Students' Association (London): Address by G. Lemmens.	30, Russell Square, London, W.C.1.
29	Royal Institution: "On Films." Sir William B. Hardy. 9 p.m.	21, Albemarle Street, London.
30	Institute of Metals (N.E. Coast Section): Joint meeting with the Institution of British Foundrymen.	Neville Hall, Newcastle-on-Tyne.

Phenol : Its Synthesis, Uses, and Derivatives

By G. Malcolm Dyson, B.Sc., Ph.D., A.I.C.

THE enormous number of uses to which phenol has been put during the last few years has led to a correspondingly large increase in the amount of that substance from various sources, and although at the present time the amount of phenol produced in this country from coal-tar sources is adequate to meet the normal demands, in other countries, notably America, less fortunately situated, the demand for phenol has outstripped the production from coal-tar, so that it has become necessary to synthesise phenol from a cheaper and more plentiful starting-point.

The starting-point chosen is, of course, benzene, and the general outline of the process is to sulphonate the benzene, and convert the sodium salt of the benzene-sulphonic acid so obtained into phenol by means of a caustic soda fusion; but there are many alternative ways in which the steps of the process can be accomplished, so that a somewhat detailed comparison of their respective merits is needed. The benzene is liable to contain paraffins and olefines, together with sulphur compounds such as carbon bisulphide and thiophene. The paraffins and olefines are comparatively harmless, but the carbon bisulphide is particularly harmful and is usually removed by a process involving the freezing of the benzene and the separation of the mother-liquor from the crystals of pure benzene. The sulphuric acid used requires careful control. The presence of lead in it has no appreciable effect on the reaction, bht the presence of small traces of nitric acid must be carefully avoided, as they cause a darkening of the product due to oxidation as well as nitration.

Sulphonation of Benzene

This step in the process may be summarised by the equation

$$C_6H_6 + H_2SO_4 = C_6H_5 . SO_3H + H_2O$$

and can either be performed by refluxing together the benzene and the acid, or by passing the vapour of benzene through sulphuric acid heated to 120–200° C. Of course, the primary aim is to obtain the maximum amount of benzene-sulphonic acid with the use of the minimum of sulphuric acid, not only because of the initial cost of the acid, but also on account of the enhanced cost of neutralisation, and bulk of products, entailed by the use of a large excess of acid. To conserve the acid used in sulphonation the following points are to be observed :—

(1) *Strength of acid.*—The strength of acid used must be carefully considered, and regulated so that the spent acid remaining after sulphonation is as little as possible. As a general rule the higher the percentage of sulphuric acid (H_2SO_4) in the vitriol used, the smaller the excess required to complete the sulphonation. In the accompanying curve (Fig. 1) the quantities of acid left after the sulphonation of the same

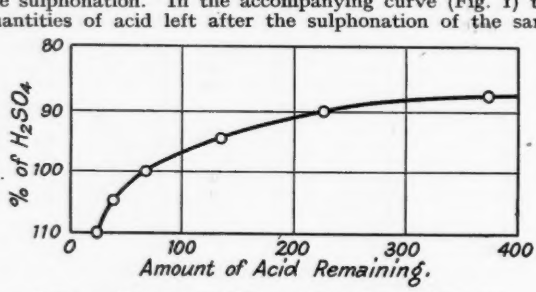


FIG. 1.—EFFECT OF CONCENTRATION OF ACID ON QUANTITY USED.

amount of benzene with different strengths of acids is shown. The runs were so adjusted that the benzene was completely sulphonated, and the acid remaining was of an 80 per cent. strength.

Obviously the use of a weak acid means the presence of a very large excess of acid for sulphonation to be complete, which also involves the use of a very large sulphonating kettle. In practice an acid of 96–97 per cent. is used.

(2) *The "Kettle."*—The sulphonation vessel, or "kettle," is constructed of cast iron, and is provided with reflux condenser, stirring gear, overflow pipes and a capacious runaway (Fig. 2). The runaway is placed at the bottom of the vessel, and the cock is as near to the vessel as possible. Heating is accomplished by means of a steam jacket, which is separated from the actual kettle by means of a water jacket. This gives an easy and rapid method of controlling the heat supplied to, or taken from, the kettle.

(3) *The order of mixing.*—This apparently small detail has a profound influence on the economy of the reaction. In the earlier plant the acid was placed first in the kettle, and the

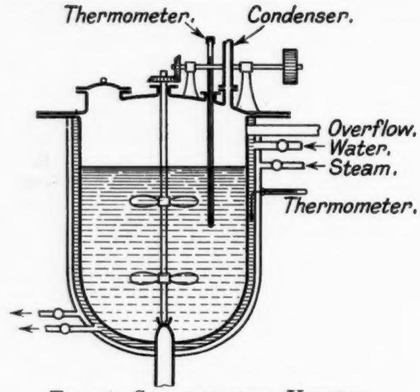


FIG. 2.—SULPHONATING KETTLE.

benzene, after weighing, was allowed to run in. This procedure, even with vigorous stirring, produces considerable local overheating, and consequently dark coloured products, together with from two to four per cent. of diphenylsulphone are formed by side-reactions. By reversing the order of admixture, and running the acid slowly into the benzene the formation of these by-products is avoided. In addition, as long as adequate stirring gear is provided, the temperature of the charge cannot rise much above 80° C., a fact which renders it possible to use an oleum containing up to 20 per cent. of SO_3, thus effecting a great saving in acid.

(4) *Disposal of water.*—In the ordinary method of sulphonation, the water is retained in the kettle, with consequent dilution of acid and decrease in the efficiency of the process. To avoid this several plants have been designed in which the water is removed as fast as formed. The most important device of this nature, which is now operating successfully in a French plant, consists of passing the vapour of benzene through sulphuric acid at temperatures from 120–200° C. Water and any excess of benzene distil off. The drawback to the process lies in the complicated plant necessary to condense and separate the water from benzene and return the latter to the vaporising plant. The advantages of the method may be summarised thus :—

(*a*) 90 per cent. sulphuric acid can be used.

(*b*) The yield of benzene-sulphonic acid is good, and is not contaminated with much residual sulphuric acid. A sample drawn at the end of a run had the following percentage composition :—

Benzene-sulphonic acid	83
Sulphuric acid	12
Water	3
Insoluble matter	2

(*c*) The process is one of comparative rapidity.

Attempts have also been made to sulphonate benzene under pressure, but, so far, with little success.

Sodium Benzene Sulphonate

The method of conversion of the benzene-sulphonic acid to the sodium or magnesium salt required for the alkali fusion, differs in nearly every plant. Conversion to the magnesium salt is performed by the addition of magnesia or magnesium carbonate, but although the method produces a saleable by-product—magnesium sulphate—the enhanced amount of caustic soda required in the alkali fusion renders the cost of the process considerably higher than that of the method using the sodium salt. This latter salt can be obtained either by

the direct conversion of the acid to the sodium salt or by the intermediate preparation of the calcium salt. Where the latter process is chosen the benzene-sulphonic acid is run, with stirring, into "milk of lime." In order to avoid the production of an unfilterable slime the precipitation should be done with hot solutions, and care should be taken to end the precipitation with the liquor faintly acid. The solution of calcium salt is treated either with sodium carbonate, sodium sulphite (from the alkali fusion) or sodium sulphate when the calcium is precipitated, leaving a clear solution of the sodium salt which can be evaporated.

The direct conversion of the acid to the sodium salt can be performed by the addition of sodium carbonate—an expensive process, or by adding sodium sulphite (from the fusion). In the latter case the liberated sulphur dioxide can be utilised in the liberation of phenol from the sodium phenate solution obtained later in the process. A novel and economical process is to roast the benzene sulphonic acid with salt in a saltcake furnace when the reaction

$$C_6H_5SO_3H + NaCl = C_6H_5SO_3Na + HCl$$

The hydrochloric acid is absorbed and utilised in the usual way. The evaporation of the sodium benzene-sulphonate solution can be done in several ways. Some plants use the cascade process, and others multiple effect evaporation. The salt can conveniently be dried by means of hot flue gases.

Alkali Fusion

The kettles used for this process are of cast iron of elongated hemispherical shape and set in a steel shell lined with brick and asbestos. Oil or gas firing is the most satisfactory, and the kettles should be fitted with powerful stirring gear and a thermometer, preferably recording. The drying of the sulphonate should be carried to such an extent that the contents of the fusion pot will contain about 25 per cent. of moisture. The caustic soda (about 2½ mols. for each mol. of sodium benzene-sulphonate) together with 10–15 per cent. of the total charge weight of water are mixed in the kettle and brought to about 250° C. at which temperature the sodium benzene-sulphonate is charged in. The temperature during fusion is kept between 290–350° C., any excessive rise in temperature being avoided since it leads to darkening and decomposition, while a low temperature leads to the formation of lumps and an excessive thickening of the melt. As a rule, the melt proceeds quite quietly. It has been found advisable to keep air out of the kettle as far as possible, since its presence decreases the yield. In an experimental run air was bubbled through the melt and resulted in a 20 per cent. decrease in yield.

In the older process it was customary to cast the melt into blocks, to powder these and extract with water, but it is preferable to run (or ladle) the melt straight out into water. A comparatively small amount of water is used so that the sodium sulphite remains undissolved and may be filtered off. The best filter material is nickel gauze, although some French plants have successfully utilised sharp sand.

The liberation of phenol from the sodium phenate liquor ("striking out") can be done by any of the following agents :—(1) Sulphuric acid; (2) Nitrecake, $NaHSO_4$; (3) Carbon dioxide; (4) Sulphur dioxide.

The use of sulphuric acid is expensive and wasteful, entailing considerable loss from bad separation of the phenol layer. The nitrecake process suffers from two serious drawbacks in that, for obvious reasons, it must be quite free from traces of nitric acid, and, also, that a large quantity of water is required to dissolve the sodium sulphate formed. Carbon dioxide from the lime-kiln is as ideal a precipitant as can be expected. It converts the caustic to sodium carbonate which can easily be re-causticised and returned to the cycle. The phenol layer is separated from the aqueous layer, but much phenol is lost if the aqueous layer is not treated for the phenol it contains. The phenol can be extracted with benzene, but when carbon dioxide is used as a precipitant the phenol automatically goes back to the fusion kettle after re-causticisation. The phenol is distilled, the following fractions being collected :—

(*a*) Up to 105° C.	First runnings	Returned to lixiviating troughs.
(*b*) 105–180° C.	Aqueous phenol	Returned to the crude phenol store.
(*c*) At 180° C.	Pure phenol	
(*d*) Residues	"Bottoms"	Used in the preparation of sheep-dip.

The flow sheet shown in Fig. 3 gives a general idea of the working of the plant. The yields by this process are good, the best yet attained being 90 per cent. of the theory. The following are the sources of loss, chief among them being the first :—

(1) Incomplete sulphonation, and loss of benzene by volatilisation.

(2) Mechanical loss in the isolation of sodium benzene sulphonate.

(3) Imperfect fusion owing to low temperature and incomplete mixing.

(4) Mechanical loss of phenol in "striking out."

(5) Sulphonation of phenol during "striking out."

(6) Loss of phenol in aqueous solution run to waste.

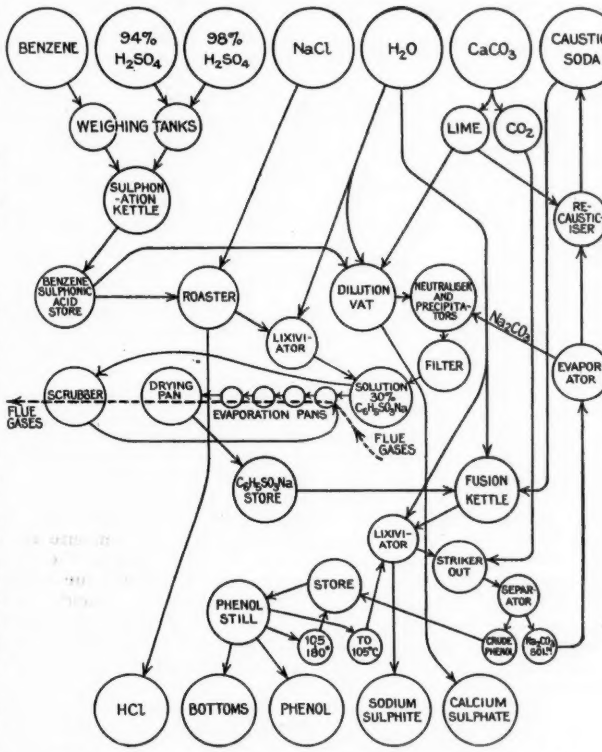


Fig. 3.—Flow Sheet of Synthetic Phenol Plant.

The phenol obtained by this process is of good quality, and after a further distillation gives excellent white crystals; furthermore, granted a comparatively pure benzene as the starting-point, it is free from cresols—a property which is of no small advantage in certain industrial operations.

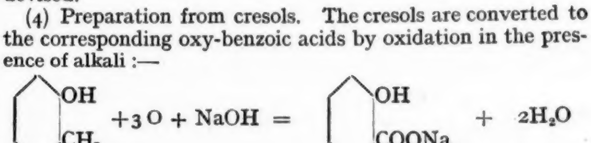
Other methods have been suggested, and in some cases introduced on a commercial scale, for the preparation of phenol, but none of them approach the one already described in cheapness of production. Chief among the lesser methods are :—

(1) The conversion of benzene to nitrobenzene, the reduction of the latter to aniline and the formation of phenol from the aniline by means of the diazo-reaction.

(2) An alternative method for the production of phenol from benzene. The benzene is converted to chlorbenzene, which is reacted with caustic soda solution.

(3) Preparation from benzene by catalytic oxidation. This seems to be the natural process of the future, but at present no satisfactory method for carrying out the process has been devised.

(4) Preparation from cresols. The cresols are converted to the corresponding oxy-benzoic acids by oxidation in the presence of alkali :—



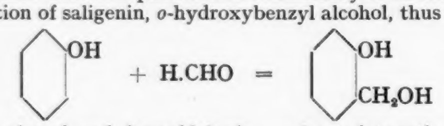
The oxidation can be done by (*a*) Air; (*b*) Copper oxide; (*c*) Electrolytic means. The free acid is liberated by means of

sulphuric acid and dried alone, or by heating under anthracene oil. Phenol is obtained by fusion with alkalies.

The principal substances involving the use of phenol can be classified under the following heads:—(1) Synthetic resins (2) Disinfectants and antiseptics; (3) Synthetic drugs, dyes, etc.; (4) Explosives—picric acid, etc.; (5) Hydrogenated phenol solvents—cyclohexanol and cyclohexanone.

Synthetic Resins

The versatility of synthetic resins of the phenol-formaldehyde class has rapidly made them of considerable interest and importance. The simplest form of condensation that can take place between phenol and formaldehyde results in the formation of saligenin, *o*-hydroxybenzyl alcohol, thus:—



but if phenol and formaldehyde are heated together in the presence of certain basic catalysts (such as caustic soda or ammonia) a whole series of resinous compounds are obtained, which can be put to various uses according to their states of polymerisation.

The reaction between phenol and a limited amount of formaldehyde results in a liquid, pasty, or solid resin known as "Bakelite A," which is fusible and soluble in organic solvents. It can be used as a cement basis and for the manufacture of synthetic varnish resins. It cannot be used straight away in the preparation of varnish and paint compositions, since it is incompatible with natural resins, and cannot wholly take their place. However, by heating the synthetic resin with 50 per cent. of its weight of natural resin a reaction takes place, resulting in the formation of a synthetic resin (Albertol) which can be utilised with excellent results in varnish manufacture.

By using an acid catalyst a resin of the so-called "saliretin" type is obtained, which is used as a substitute for shellac. It is, however, not as satisfactory for many purposes as the resin obtained from Bakelite A, being inclined to discolour badly, and to retain traces of acid which manifest themselves later by the corrosion of metal surfaces. "Bakelite A" can be converted by heating ("curing") into the substance "Bakelite B" a brittle solid, infusible, and insoluble in acetone. It has not *per se* received any industrial application, but on further heating it is converted into "Bakelite C," a product of considerable industrial importance. It is a strong, hard, resistant substance, infusible, and insoluble in organic media, and unattacked by water and dilute acids. These properties, taken together with its high electrical resistance, and adaptability by moulding, render it eminently suited to the manufacture of a large variety of electrical apparatus, previously reproducible only in porcelain or ebonite. It can be coloured in almost any way.

Practically it is prepared in two stages. Phenol is first mixed with less formaldehyde than is required for the finished resin and heated in a steam jacketed digestor to 150° C. when a reaction takes place with the formation of Bakelite "A" and water, which latter is removed by boiling off at reduced pressure. The still liquid resin is run off and allowed to solidify. It is then masticated with a quantity of hexamethylenetetramine—which provides the necessary extra formaldehyde, together with the ammonia for catalysis—and heated until nearly converted to Bakelite "C." The almost finished and powdered material can then be mixed with appropriate fillers, colouring matters, and plasticisers (*e.g.*, albumen, tung oil, hard "oil bottoms," etc.), and moulded into shape, after which the articles are toughened by a curing process usually consisting of heat treatment in ovens.

Among the articles that have been successfully manufactured in this way may be mentioned insulating blocks for general electrical and wireless purposes, heat insulating handles, mountings for optical lenses and a variety of small moulded "fancy" goods. The latest available figures show that the world's annual output of raw synthetic resins was 10,000 tons, of which America produced 5,000 tons.

Disinfectants and Antiseptics

Phenol itself has marked disinfectant properties, and was for this reason introduced into surgery by Lister. It has slight local anæsthetic properties and at the same time acts as a comparatively strong caustic. As a general disinfectant it has been replaced by a variety of more powerful substances—mainly coal-tar derivatives; but it maintains its position as the standard of comparison for other disinfectants in the Rideal-Walker test, in which the dilution to which a disinfectant must be reduced in order to have the same germicidal effect on a standard culture of *B. Typhosus* is taken as a measure of its disinfectant activity.

Manufacturers and testing chemists still cling to the Rideal-Walker test as the standard method of disinfectant evaluation in spite of its manifest unsuitabliity in many cases. If disinfectants were used, as in early days for killing *B. Typhosus* in excreta, tissues, etc., then standardisation against that organism would have some point, but at the present time it would seem more reasonable to test the disinfectant on the organism against which it is to be used. Disinfectants for *B. Anthracis*, various staphylococcus, streptococcus and streptothrix organisms are becoming more common, and there seems every reason that they should be tested against these organisms, in comparison with a substance (not necessarily phenol) of a known activity in the specific direction.

Phenol is the starting-point for the manufacture of a large number of organic medicinal chemicals, among which are:—

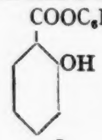
(1) *Salol.*—(I.) Phenyl salicylate, obtained by the condensation of sodium phenate and sodium salicylate in the presence of some condensing agent such as phosphorus oxychloride or phosgene. It is used as an internal antiseptic.

(2) *Guaiacol.*—(II.) Catechol monomethyl ether, obtained from phenol through the medium of *o*-nitroanisole. It gives rise to guaiacol carbonate or "Duotal" (III.) and potassium guaiacol sulphonate or "Thiocol" (IV.).

(3).—2 : 4 : 6 *Tribromphenol* (V.) is used as the bismuth salt (Xeroform) which is a non-irritating antiseptic much used for the dressing of wounds and ulcers.

(4) *Sozoiodol.*—2 : 6 Di-iodophenyl-4-sulphonic acid (VI.) is an important antiseptic for nasal and pharyngeal disorders.

(5) *Aspirin.*—This compound—acetylsalicylic acid (VII.) is prepared in enormous quantities from salicylic acid, which in turn is obtained from phenol.



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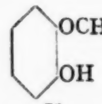

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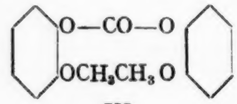

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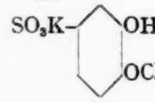
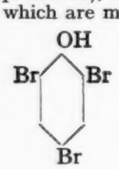


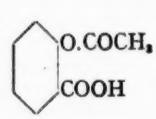
IV.

In addition to these compounds there are Salvarsan, Phenacetin, Purgen (phenolphthalein), Nosophen (tetra-iodophenol phthalein), etc., all of which are prepared from phenol, and which are much used in medicine.



V.

VI.



VII.

Manufacture of Picric Acid

The manufacture of picric acid is a process involving the successive sulphonation and nitration of phenol, and is simple to operate and control, needing little technical supervision and comparatively simple plant. The reactions involved are:—

i. $C_6H_5OH + H_2SO_4 = HO.C_6H_4.SO_3H + H_2O$

ii. $HO.C_6H_4.SO_3H + H_2SO_4 = HO.C_6H_3.(SO_3H)_2 + H_2O$ (2 : 4)

iii. $HO.C_6H_4.SO_3H + 3HNO_3 = HO.C_6H_2(NO_2)_3 + H_2SO_4 + 2H_2O$

iv. $HO.C_6H_3.(SO_3H)_2 + 3HNO_3 = HO.C_6H_2(NO_2)_3 + 2H_2SO_4 + H_2O$

The phenol should be comparatively pure, the coal-tar

variety being preferred to the synthetic for purposes of picric acid manufacture, since it contains traces of some unidentified impurity which seems to act as a catalyst in the nitration. The melting point of the phenol is not wholly to be relied upon as the criterion of suitability, since its lowering is in most cases due to small amounts of moisture which, within reasonable limits, has no deleterious influence on the reaction. The sulphuric acid most suitable for the sulphonation of phenol contains 94 per cent. of H_2SO_4. The use of an "oleum," even when coupled with extremely efficient stirring and cooling devices, leads to a poor yield of inferior picric acid, due to the formation of sulphones during sulphonation, while an attempt to use an 80 per cent. B.O.V. gave very unsatisfactory results.

Nitric acid used for the nitration must be carefully filtered from grit, which may choke up the nitration syphon, or introduce dangerous abrasive particles into the final acid.

The plant used for the manufacture of picric acid is comparatively primitive. The phenol is melted and run into a steam heated earthenware bath and mixed with four molecular proportions of sulphuric acid. In earlier days of manufacture, the two liquids were mixed by hand and allowed to stand for twenty-four hours; but by using judicious heating (two to three hours at 70° C.) the process can be considerably shortened. The sulphonate sets to a white jelly on cooling and is diluted before nitration, in order to avoid loss by violent nitration coupled with oxidation of the phenol to oxalic acid. The proportion of sulphonate jelly to water is about 50 : 50 by weight, and the diluted sulphonate solution is run into settling tanks and decanted from any sediment.

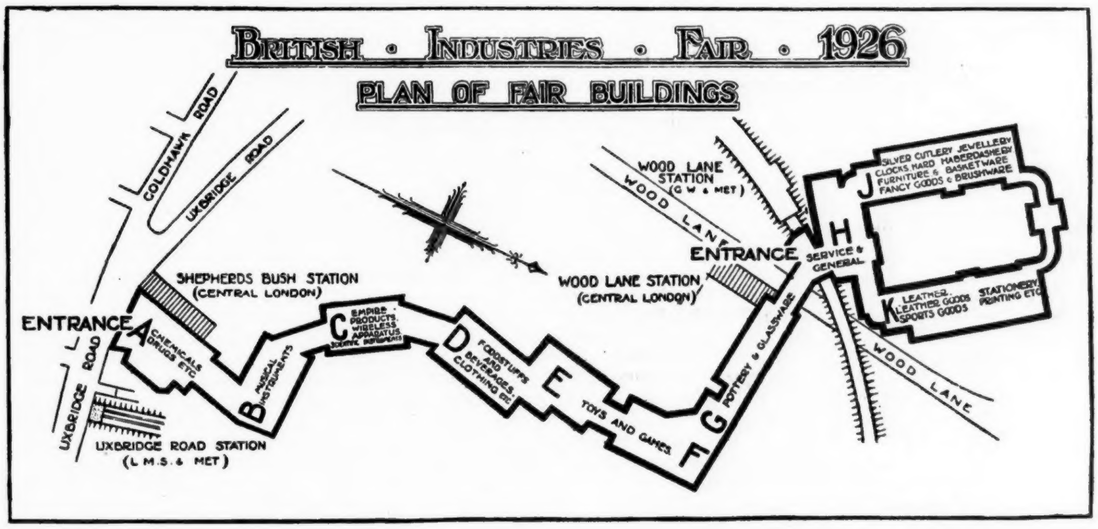
The sulphonate solution from about 40 lb. of phenol is run into an earthenware pot of 50–60 gals. capacity. No temperature regulating or stirring devices are provided, and the nitric acid (160 lb. of S.G. 1·4) is run in through a glass syphon at such a rate that the addition takes four to five hours. The acid is allowed to flow on to the surface of the sulphonate liquor. Nitration usually commences at once and can be left to complete itself. In some cases, usually about one in fifty, the reaction starts suddenly and violently with oxidation as well as nitration, and results in a diminished yield of picric acid.

The picric acid separates out in small crystals ("grain") and in larger aggregates ("lumps"). The latter are more or less impure, containing inclusions of dinitrophenol and are crushed up and returned to the pot. After standing for two days the crystals are removed and washed thoroughly with water, in vats provided with agitating paddles. Centrifuging and stoving complete the drying operations.

The British Industries Fair

Arrangements for the Chemical Section

THE British Industries Fair, as intimated in previous announcements, will be held simultaneously at London and Birmingham from February 15 to 26. The Chemical Section will be housed at the White City, and the plan reproduced on this page shows the exact position of the section. The bookings at Birmingham promise a display greater than even the record of last year; it has now been found necessary to make a large extension to the permanent exhibition buildings at Castle Bromwich. This is partly due to the important electrical section, which this year, for the first time on a considerable scale, has been organised by the trades concerned. The general engineering section is three times as large as on any former occasion.



The Chemical Section in London will be situated in the same hall as on previous occasions—namely, immediately inside the Shepherds Bush entrance. The main feature will be an interesting display by a number of manufacturers of fine chemicals of their new products. The development in this branch of chemical industry has been very striking during the past ten years. Over a thousand fine chemicals which were not previously made in this country are now being produced. They include chemicals used in research, analytical chemicals, photographic chemicals, new medicinal products of a particularly interesting type, and other chemicals of national importance. In addition, there will be displayed chemical products from gas works, showing raw materials and intermediate products which are used in the manufacture of dyestuffs and finally a specialised range of dyestuffs of great interest to users. Such colours make a particular appeal to the eye, and the same may be said of those chemicals which are produced in definite crystalline form. The exhibit of crystals of alum, bichromates and cyanides shown together in one case will serve to remind the buyers of those products that this country is still pre-eminent in their manufacture.

Royal Patronage

To mark the opening of the Fair a banquet will be given by the Government on the first day, to be held at the Mansion House. The Prince of Wales will be the principal guest, and Sir P. Cunliffe-Lister, President of the Board of Trade, will preside. The guests will include the Lord Mayor of London, City and Court officials, and leading representatives of banking, industry, and commerce. Exhibitors and overseas buyers will also be present.

The annual banquet of the Birmingham Chamber of Commerce will take place during the first week of the Fair, and prominent home and overseas buyers will be invited. The Duke of York will visit the Birmingham section on or about February 18, and the King and Queen will probably visit the White City during the first week of the Fair.

The public will be admitted to the Fair from 5 p.m. to 8 p.m. each day, and from 1 p.m. to 8 p.m. on Saturday, February 20.

Synthetic Organic Colours for Lake Making

Effect of Changes in Constitution

ADDRESSING a meeting of the Manchester Section of the Oil and Colour Chemists' Association on Friday, January 15, Dr. F. M. ROWE, of the Manchester College of Technology, dealt with synthetic organic colouring matters used in the lake-making industry. Whilst the physical properties of lakes depended very largely upon the skill and experience of the lake manufacturer himself, said Dr. Rowe, such properties as resistance to heat, and fastness to light, oil, spirit, acids and alkalis, and water were, however, dependent to a very great extent upon the constitution of the colouring matter which entered into the manufacture of the lake, though the lake maker himself could also influence the fastness of pigment colours by the degree of dilution and the nature of the diluent. An example was the case of Lithol Fast Yellow R which, normally, was fast to light. The degree of fastness was poor, however, when diluted with barytes or white lead. The fastness to light of many other colouring materials was unaffected by admixture with barytes or white lead, though they were no longer fast when mixed with zinc white. An explanation of this which had been advanced was the ultraviolet rays were absorbed by zinc white and reflected by white lead or barytes.

The author, discussing the azo derivatives, said the azo compounds formed by coupling diazotised nitroanilines and their homologues with betanaphthol were of great importance in lake making. The earliest example was Para Red, whose lakes, if well made, were fast to water, of good fastness to light, moderately fast to lime, but not fast to oil or spirit, and sensitive to heat. Bluer shades resulted from the use of betanaphthol containing some betanaphthol sulphonic acid, and these naturally possessed improved fastness to oil and heat.

The products from diazotised nitrotoluidines coupled with betanaphthol were of much greater interest and value. M-nitro-*p*-toluidine, for example, gave Helio Fast Red RL, Lithol Fast Scarlet R, etc., which were used very largely for yellowish-red lakes of considerable covering power, fast to light, water, and lime, and sufficiently fast to oil and spirit. The common generalisation that diazo-compounds were coupled with alkaline naphthol solutions was scarcely applicable to azo pigment colours, as in many cases the shade would be ruined by such conditions, and the regulation of the condition of neutrality or even acidity in coupling betanaphthol for some colours required considerable skill. Moreover, some amino-compounds were not sufficiently basic to diazotise satisfactorily under ordinary conditions and special methods must be used. Such a compound was *m*-dinitroaniline, which when diazotised and coupled with betanaphthol in acid solution gave Monolite Red R, Lithol Fast Orange R, and Permanent Red 2G. This colouring matter furnished bright orange lakes of good covering power, fast to light and water, limes and acids, of good fastness to oil and spirit, and unaffected by heating to 140-150 degrees C. The dry colouring matter should not be ground with red lead as the presence of the two nitro groups might lead to an explosion.

Colours from Disubstituted Aniline Derivatives

Most valuable of the colouring matters already described, said the author, were those derived from disubstituted aniline derivatives, particularly those which contained a nitro group in the *o*-position with respect to the azo group. In the absence of carboxyl groups, the lakes were usually prepared by prolonged grinding with the substratum which increased the intensity. The colours ranged from yellowish-red to bluish-red, and were used for lithographic and printing inks and for oils and varnishes. The fastest of these red betanaphthol derivatives were, in general, insufficiently blue in shade, whilst the bluest lacked fastness to oil and spirit. The replacement of betanaphthol by betahydroxynaphthoic acid, however, gave bluer shades of red, which were fastest to light in the case of the calcium lakes.

Discussing the azo derivatives of betanaphthol, obtained by coupling with diazo-compounds containing sulphonic groups, these acid dyes formed lakes by double decomposition. One of the earliest, obtained by using diazotised sulphanilic acid, was Orange II. The preparation of the lake by diazotising barium sulphanilate, neutralising with barium carbonate and coupling with betanaphthol in the presence of Turkey red oil had been recommended. The isomeride from alphanaphthol, Orange I, was not used for lake making, but it was one of the colours officially permitted for colouring foodstuffs in Australia and the United States. Diazotised *p*-nitroaniline-*o*-sulphonic acid gave Lake Red P, which was one of the most important dyes in the pigment industry for vivid yellowish-red barium or calcium lakes of great covering power and good fastness to light, oil, spirit, and water. These lakes should be prepared cold as the shade was impaired by heating. The isomeride from *o*-nitroaniline-*p*-sulphonic acid was the much yellower Fast Orange O, whose lakes were much less valuable than those of Lake Red P, though faster than those of Orange II. The use of diazotised chloroaniline sulphonic acids and their homologues with betanaphthol was more recent. Thus, 5-chloroaniline-2-sulphonic acid gave Permanent Orange R for rather bright orange lakes of good fastness to light, oil, and water; 5-amino-2-chlorotoluene-4-sulphonic acid gave the largely used Lake Red C, whose barium lake, prepared at the boil, was red and of very good fastness, whereas lakes prepared by mixing were yellower-red to orange. The isomeric 4-amino-2-chlorotoluene-5-sulphonic acid was also used for bright orange-red lakes of slightly better fastness, particularly to lime, whilst 2-amino-3-chlorotoluene-5-sulphonic acid gave orange-red lakes of greater covering power and greater fastness to light and other influences. Helio Red RM and RMT were probably made from one of the last two chlorotoluidine sulphonic acids and betanaphthol.

Importance of Tobias Acid

The most important naphthylamine sulphonic acid for diazotisation and coupling with betanaphthol was Tobias acid. The product was Lithol Red R whose barium Lake, Lacitin Red R, was bright bluish red, and calcium lake, Lacitin Red B, was even bluer. The great fastness of these lakes to light, alkalis, oil, spirit, and water, and great covering power had established Lithol Red R as one of the most important and largely used dyes of the pigment industry, though it was less fast to light than Lake Red P, Lithol Fast Scarlet R, or Pigment Scarlet 3B. Had Lithol Red R been faster to light it would have been almost a perfect lake colour.

A number of azo dyes used in lake making contained the carboxyl group and were obtained either by coupling diazotised anthranilic acid with suitable components or by coupling suitable diazo-compounds with betahydroxynaphthoic acid. Diazotised anthranilic acid coupled with betanaphthol gave Lake Red D for bright yellowish-red lakes, fast to alkalis and water, and of moderate fastness to light, oil, and spirit. The use of betahydroxynaphthoic acid in place of betanaphthol gave a dye of no greater commercial value, but R salt gave the much more important and largely used Pigment Scarlet 3B. When properly made, the bright bluish-red barium lake of the latter was fast to oil and spirit and approached alizarine lake in fastness to light. The resistance to heat was good, the fastness to water was sufficient for practical purposes, but the lake was very sensitive to acids and was not fast to alkalis. The use of Schæffer's acid in place of R salt gave Pigment Scarlet G, whose yellowish-red lakes possessed sufficient fastness to oil, spirit, and water, but were much less fast to light than those of Pigment Scarlet 3B, approximating in this respect to the fastness of Lake Red P. Both Pigment Scarlet 3B and G, however, also formed much yellower lakes of greatly inferior fastness to light if incompletely combined with the metallic salt, or if a deficiency of the latter were used. The most important azo derivatives of betahydroxynaphthoic acid were those formed by coupling with diazo-compounds containing the sulphonic group. Diazotised *p*-toluidine-*m*-sulphonic acid gave Lithol Rubine B and Permanent Red 4B extra, whose lakes possessed good covering power, good fastness to oil, spirit, water, and lime, and were resistant to heat though sensitive to acids. The lake prepared with barium chloride and Turkey red oil was bright red and of greater purity than that from Lithol Red R, but of much the same fastness to light. The bright bluish-ruby-red calcium lake, however, was much faster to light. The tendency of these lakes to bronze was a characteristic property of this colouring matter. Diazotised 5-amino-2-chlorotoluene-4-sul-

phonic acid gave Lithol Red 3B, whose lakes were bluer and faster than those of the corresponding betanaphthol derivative Lake Red C. Diazotised 2 : 4-dinitroaniline-6-sulphonic acid gave Hansa Rubine whose clear bluish-red lakes possessed good covering power and were fast to light and oil.

Pyrazolone Derivatives

The group of pyrazolone derivatives included greenish-yellow and orange-yellow colouring matters of considerable fastness to light, though it was only in exceptional cases that it even approached that of Alizarine lake. A number of these colouring matters were used as non-poisonous substitutes for Chrome Yellow, which were not sensitive to sulphuretted hydrogen. The compounds containing sulphonic groups usually gave lakes of good transparency and fastness to spirit, but of low fastness to water. Tartrazine, which was made by heating two molecular proportions of phenylhydrazine-*p*-sulphonic acid with dioxytartaric acid, formed reddish-yellow lakes of good fastness to light. The use of the hydrazine from 2-amino-3-chlorotoluene-5-sulphonic acid gave the more recent Radial Yellow 3G whose pure greenish-yellow lakes were much faster to light than Quinoline Yellow lakes and were fast to oil and spirit, but of only moderate fastness to water. Most of the important lake colours in this group, however, were made by coupling diazo-compounds with various pyrazolone derivatives. A largely used compound for this purpose was 1-phenyl-3-methyl-5-pyrazolone. Diazotised *o*-toluidine, for example, gave Pigment Chrome Yellow L which, by mixing with substrata, gave orange-yellow lakes of good covering power fast to light, water and lime, but of moderate fastness to oil and spirit. Diazotised *o*-amino-*p*-sulphobenzoic acid gave Pigment Fast Yellow G, whose golden-yellow barium lake was of good fastness to alkalis, spirit, and water, and in full shades was almost as fast to light as Alizarine lake, though pale shades were only about one-quarter as fast to light. Diazotised 2-amino-toluene-5-sulphonic acid gave Pigment Fast Yellow whose barium lake was redder and less fast to light than that of Pigment Yellow G. Diazotised Primuline also gave a colour for lake making, Dianil Yellow R. Some important yellow colouring matters for lake making, formed by coupling diazo-compounds with acetoaceticanilide and similar compounds were usually included for convenience among the pyrazolone derivatives.

Dr. Rowe also gave examples of lake making colours included in the nitroso, nitro, quinoline, ketonimine, triphenylmethane, xanthene, thiazine, and anthraquinone groups.

Discussion

In the course of the discussion, Mr. J. B. Shaw, who occupied the chair, stated that there was a serious absence of literature dealing with the subject of the constitution of colours used in lake making. Would Dr. Rowe be willing to give members information at any time? The problem of fastness to light was interesting but what actually constituted fastness to light? They ought to have some definition. They had had a case recently where Hansa yellow, used in conjunction with lithopone, had faded very considerably. German as well as British colours were thus affected.

Dr. Rowe said he had been asked if, in the event of a member submitting a sample of unknown colour, he would do his best to determine the constitution. He would. He regarded such work as part of the duties of a colour chemist. With reference to the Colour Index, the first edition was prepared under very considerable difficulties. At present he and his co-workers were engaged on the preparation of the first supplement which, it was hoped, would be published about the end of the present year. A point had been raised regarding isomerides. If a series of compounds did contain a useful member very often the related isomerides had no use at all. Why it should be so was a difficult question to answer and there was no uniform explanation. At present there seemed to be nobody working on the subject. In their own industry some very good results were obtained when dealing with particular bases and bad results when dealing with other bases. That ought to be investigated. He had given them a few examples, the only explanation he had seen offered was that of a German chemist, and that was in the case of variations in the effect by mixing with barytes and white lead compared with the effect produced by mixing with zinc oxide. That explanation referred to the action of ultra-violet rays. The whole question of fastness to light was mainly a question of degree. What was wanted was the establishment of standards. If there were no people available on the staffs colleges or in works' laboratories it should be the business of the Oil and Colour Chemists' Association to see that they were available to do the many investigations required.

Platinum Laboratory Apparatus

Some useful tables of weights of platinum sheet and wire are contained in a booklet on the precious metals just issued by Johnson, Matthey and Co., Ltd., of Hatton Garden, E.C.1, smelters and assayers to the Royal Mint and the Bank of England. This describes the metals, alloys, and salts prepared by the firm, also crucibles, dishes, and other apparatus. Platinum is supplied in the form of wire, foil, and sheet, in the liquid state for potters, and alloyed with iridium, silver, rhodium, etc. Platinum-silver alloys are prepared for dental purposes, while pure platinum and iridio-platinum are in use for thermo-couples. Platinum crucibles and covers in all sizes are also illustrated, these including Gooch crucibles, the approximate weights being given in every case. Dishes are made in sets, each dish fitting into the one of next larger size, these ranging from 30 to 600 c.c. capacity and 5 to 13 cm. in diameter. Platinum apparatus for electrolysis is made in shapes to suit every need, while other plant illustrated includes platinum gauze, filter cones, triangles, cautery points, platinum-tipped tweezers, iridio-platinum spatulas, etc.

Platinum apparatus for gold assaying as used by the principal mints and assay offices throughout the world is also described in the booklet, which contains interesting details of the international standard weights and measures made of iridio-platinum. This alloy, containing 90 per cent. platinum and 10 per cent. iridium, and first shown by Johnson, Matthey and Co. at the Vienna Exhibition, 1873, was finally adopted by the Paris International Commission, and all the standard metres and kilos for international use have been subsequently prepared and supplied by them of this alloy and form to the International Committee of Weights and Measures. The experts appointed to determine the quality of the platinum employed reported its purity as 999·98773 per 1,000 parts, a degree of refinement heretofore (1873) considered commercially impossible, and, except by their special process, even now only attainable in laboratory experiments of a very costly nature, and dealing with small quantities. The weight of platinum employed in the manufacture of these standards was 250 kilos, or about 8,000 ounces troy, and the preparation of so large a quantity of platinum to the above high degree of purity is considered to be unsurpassed in metallurgical annals.

Dryers for Chemical Works

The problem of economically drying materials in which only a small amount of residual moisture is permissible, or which would be injured if dried at high temperatures, is one which has always been difficult to solve. Vacuum ovens or shelf dryers are frequently used, but they require a considerable amount of labour in charging and discharging. The "Johnstone" Dryer "Vacuum"-type, as described in the pamphlet from Manlove, Alliott and Co., Ltd., Bloomsgrove Works, Nottingham, has been found very suitable for drying certain materials with the minimum of handling. It consists essentially of an enclosed vacuum-tight vessel with dome-shaped cover carrying a scraper, agitators, and driving gear. In the cover is a large circular charging door provided with shackles for tightening screws. The body has steam jacketed parallel sides and a steam jacketed flat bottom and is constructed of cast iron or mild steel plates or of cast iron. The steam jackets work at a pressure of 40 lb. per square inch. In the side of the dryer there is a rectangular hinged and balanced discharge door which is fitted with a conveniently manipulated tightening device for closing it on to a suitable joint ring. Alternatively a door may be fitted in the bottom. The material is put in in bulk, and is discharged automatically through the bottom door in a dried condition. A thorough and speedy drying is ensured as the material is continually broken up and turned over by revolving scrapers and rakes. The tedious operation of spreading the material is entirely eliminated. No impervious crust can form to hinder the rate of drying.

A copy of the pamphlet, 750B, will be sent to all interested readers who mention The Chemical Age.

Cellulose Enamels

Paper before Oil and Colour Chemists

Dr. H. Houlston Morgan, President, was in the chair at the meeting of the Oil and Colour Chemists' Association in London on Thursday, January 14. Two papers, one dealing with cellulose enamels by Mr. A. E. Lain, and the other with leather japanning by Mr. W. T. Lattey, were read.

Mr. Lain said the use of cellulose lacquers had increased enormously since the war, and lacquer finish was now firmly established as an alternative to oil varnish, but only recently had manufacturers used it on larger surfaces such as motor car bodies. The common metal lacquer usually contained not more than 5 per cent. of cellulose nitrate in a mixture of solvents serving to delay the tarnishing of metal, not acting as a finishing material. Research had been carried out with a view to increasing the solid content and improving the adhesion and rubbing qualities of lacquer films. In order to increase the solid content, it became necessary to produce a cellulose nitrate which, when dissolved in suitable solvents, gave a solution of low viscosity, and this had been achieved. The addition of natural resins was found to impart adhesion and rubbing properties in varying degrees. As resins did not appreciably affect the viscosity of the solution, it was now possible to spray a lacquer containing 26 per cent. of solids, of which 16 parts might be cellulose nitrate and the remainder resins and plasticides. Lacquer films hardened by the evaporation of the solvents whilst the rate of hardening of the varnish film was dependent upon the rate of oxidation of the drying oil. One would expect a lacquer of high solid content to be subject to case hardening, but he had successfully sprayed and rubbed to a finish a lacquer containing 26 per cent. of solids. This amount of " body " was almost equal to that in varnishes.

Constituents of Lacquers

The usual constituents of finishing lacquers, said Mr. Lain were cellulose nitrate (low viscosity), resins, solvents, and plasticides. The cellulose nitrate was the most important solid constituent as it formed the bulk of the film and rendered it tough and inert to the liquids. The resinous portion made the film adhesive and glossy, as the proportion of resin was increased, so the film lost its desirable properties and more nearly resembled an oil or spirit varnish film. The solvents controlled the rate of drying, degree of gloss, and viscosity of the lacquer. Finally, the plasticides were intended to remain with the film after the solvents had evaporated to give it elasticity. It was necessary to choose cellulose nitrate giving a solution of low viscosity. When 14 to 16 per cent. was dissolved in suitable solvents it must produce a solution that could be sprayed quickly and easily. Scrap celluloid as a substitute for cellulose nitrate, though cheap, had many drawbacks and was not to be recommended for good results.

The ideal resin should be hard, cheap, and readily soluble in the solvents of low viscosity cellulose nitrate. Unfortunately, the author said, he knew of no resin which fulfilled these requirements.

Coming to solvents, it was pointed out that esters and ketones were good solvents of cellulose nitrate and were usually distinguished from hydrocarbons by the terms solvents and non-solvents, a nomenclature which was somewhat misleading because hydrocarbons were good solvents of many resins. A classification of solvents according to their boiling points, compiled by D. B. Keys, of the Industrial Alcohol Co., of New York, was then given. These were divided into " low boilers," " medium boilers " and " high boilers." The high boiling solvents were not yet in general use in this country, and extreme care should be exercised in their use owing to their slow rate of evaporation.

By a systematic study of the various resins and solvents the character of the resulting film could be predicted. Good books were available, and most of the solvents were manufactured to B.E.S.A. specifications, and these should be quoted when buying. If the resin employed was soluble in a different class of solvents to the cellulose nitrate, then a solvent for both resin and cellulose nitrate should be chosen from each group of solvents to ensure that the volatile content was well balanced and that sufficient solvent of each solid constituent was present in sufficient quantity to prevent the precipitation of either the resin or the cellulose nitrate. These lacquers were best applied by the spray.

As regards finishing, Mr. Lain said manufacturers must be prepared to give a process by which a finish might be obtained to suit the individual requirements of their customers. Pigmented lacquers and enamels had been used for many years as a protective coating for fittings, etc., but in recent years attempts had also been made, with varying success, to displace paint and varnish by these products in the finishing of motor cars.

Methods of Manufacture

Mr. Lain said he had had no experience of this, but he had knowledge of the manufacture of white and coloured enamels for interior work. The principles of manufacture were the same as for oil enamel production, and he had found the following proportions of nitrate, resin, and plasticide satisfactory for this work :—Cellulose nitrate, 12 ; resins, 6 ; and plasticide, 2. The greater the radio of pigment to medium, the weaker the film and the less glossy it would be. The best method was to keep the pigment content as low as possible so that the film dried glossy. The incorporation of the pigment into the medium was somewhat difficult. If an unsuitable machine was used there was much loss through evaporation and the fumes were sufficient to overcome the operator. Formerly the pigment was ground in castor oil or a liquid plasticide. This resulted in a too high plasticide content and formed a soft film, and the maximum dispersion of the pigment in the medium could only be obtained by grinding the pigment in the medium. If it was ground first in castor oil or plasticide, and then thinned with the medium, the dispersion could not be as good as if they were ground together. Cone mills had been used, but not found satisfactory, and the double roller mill was being used. Mr. Noel Heaton had suggested the use of ball mills, and he was informed that this kind of mill was being used extensively in the United States for the production of motor car enamels They needed no attention because there was no loss o. evaporation.

The President said there had been a flutter lately in thef Press about cellulose enamels and the revolution these would bring about in the paint and varnish industry. A good deal of this optimism, of course, was to be put down to the enthusiasm of certain people, but nevertheless there was no doubt the subject must be given attention by paint and varnish manufacturers. In the United States last year he believed that 10 per cent. of the total sales of varnishes were cellulose lacquers, but he was far from thinking that cellulose lacquers had sounded the death knell of linseed oil varnishes. It depended upon the manufacturers themselves. Linseed oil must be improved, and to do that it was necessary to know more about the raw materials. He was inclined to the belief that the eventual solution would be a compromise, and that there would be a demand for both cellulose finish and drying oil finish.

Mr. Hedley Barry referred to the difficulties in this country of purchasing the absolute alcohol for experimental purposes. He mentioned that whereas absolute alcohol could be purchased at 11s. 6d. per gallon, the duty on it was £7 per gallon, and it could only be purchased in quantities. It should be possible to purchase small quantities for research purposes, a facility now granted only to universities and teaching establishments.

Mr. Noel Heaton said it would be interesting to know how the Americans obtained absolute alcohol, because it seemed to him a very difficult thing to get rid of all the water.

Mr. Lain said he had never found any difficulties as regards containers for cellulose enamels. He had used steel barrels and not found any discoloration. Although it was possible to obtain absolute alcohol, it was very difficult to keep it so for any period. He had had no experience of the colloid mill.

Leather Japanning

The second paper was on leather japanning, by Mr. W. T. Lattey. He pointed out that the whole art of leather japanning was in the priming coat, which must take a firm grip of the surface but not penetrate. A priming coat which penetrated combined the fibres of the leather so that they could not move when bent, and so elasticity was destroyed. The fundamental point was that the elasticity of leather

allowed it to stretch 20 per cent. before breaking, and the nearer the japan approached this figure the better. A priming coat might be prepared by heating linseed oil for four or five hours at 610° F., using 4 per cent. of aluminium hydrate and ½ per cent. of Prussian blue as driers. The product was a stiff jelly which was spread on the leather with a comb-like tool and sealed up the pores. Subsequent coats consisted of linseed oil boiled with 4 per cent. of Prussian blue to the consistency of treacle and spread on in the same manner. Drying took place in an oven for 24 hours at 160° F. A method of drying the priming coats was by exposure to direct sunlight, and in this case the priming composition was swollen with petrol to a thin jelly. When good lasting priming coats had sealed the pores of the leather, almost any good quality finishing paint or varnish could be used, although he preferred manganese rather than lead as a drier for colour work. American manufacturers had utilised nitro-cellulose compositions as far back as 1900 so as to be independent of the weather, and also so as to be able to japan chrome tanned leather, which required a more pliable japan than vegetable leather.

Chemical Control in Industry

Critical Address by Dr. Forster

THE annual meeting of the Leeds area section of the Institute of Chemistry was held at Leeds on Tuesday, January 12, Professor Cobb in the chair.

Messrs. H. B. Brown, H. J. Hodsman, A. Taylor, J. T. Thompson were elected to the committee, Messrs. J. Firth and A. Clucas were elected honorary auditors, and Dr. R. B. Forster, F.I.C., was elected honorary secretary.

Dr. FORSTER addressed the meeting on "The Evolution of the Chemist and his Position in Industry." He showed that it was erroneous to say that chemistry was the child of pharmacy. He traced the evolution of the science from Egypt to Athens and from there to Constantinople, from whence it spread into Arabia. It was the founding of the Arab Caliphate in Cordova in the eighth century that firmly established the science in Europe. From the Caliphate at Cordova sprung the Spanish Universities of Cordova, Seville, and Toledo. During the eighth century these universities were visited by dilettante philosophers from England, France, and Germany, and the sphere of activity was thus diverted to these countries. Many centuries later two schools of thought sprang up at Iatro. Chemists headed by Paracelsus wished to restrict the study of the science to the preparation of medicines, and others headed by Agricola wished to advance the science for its own sake and also with a view to its application in the industries.

From the latter school arose such men as Boyle, Mayow, Stahl, Willis, Boerhave, Black, Priestly, Cavendish, and Lavoisier. The latter he described as a research chemist, works chemist, and administrator all in one.

Dr. Forster contrasted the treatment meted out to Lavoisier and his brother philosophers by Robespierre in 1794 with the attitude of Frederick William III King of Prussia to men of science a few years later. Lavoisier and 23 other members of the famous "fermier Généraux" were condemned to death by Coffinhal, who remarked "La République n'a pas besoin de Savant," whereas Frederick William, after Prussia had been laid waste by Napoleon, founded the University of Berlin and said, "mann müsse, was der Staat an physischen Kräften verloren, durch geistige zu ersetzen suchen." A comparison of the chemical industries of France and Germany 100 years later supplies the best answer as to whether "The Republic has no need for Philosophers" or "What the State has lost in brawn we must make good in brains," is the better policy.

In dealing with the position of the chemist in industry, he said that if we translate Robert Boyle's dictum "Experiment must precede deduction" into modern English we get "Research must precede manufacture," and therein lies the secret of the German success. The Universities were the breeding grounds for research; without them there could be no research, therefore no manufacture, no industry, and hence no position for the chemist in industry. This was the position we were drifting to in 1914. Since the war conditions had changed for the better, and a great many firms who did not employ chemists in pre-war days did so now, but, he was sorry to say, very much in the same sense as they employed book-keepers. That was to say, to keep things running, whereas the chief function of the chemist should be to improve existing processes, and if possible invent new ones.

Administrative Chemists

In his opinion, the administrative posts in the chemical industry should, when possible, be held by chemists, as it was quite impossible for a man without a good knowledge of chemistry to understand the problems of a chemical works, and in support of this argument he mentioned a number of chemical firms which were successful so long as they were controlled by chemists. It has been argued that if, say, the manager of a chemical works was a purely commercial man, he could call in experts to advise him on technical points; but was it not easier for the chemist to understand the formalities of commerce than the commercial man to understand the technicalities of science? Why not reverse the conditions —put the chemist in the position of managing director and let him call in external aid when he needed it. Although it was desirable to fill as many as possible of the administrative posts with chemists, every chemist was not necessarily a good administrator, but this type of man might be none the less valuable to his firm, and therefore he should be able to attain as high a position, that was to say as large a salary, in the laboratory as his brother chemist as an administrator. What did we find? The best men in the laboratory endeavoured to get into the administrative posts, the main reason being that the latter carried higher salaries. This was not as it ought to be. The better a man was in the laboratory or works, the more reason that he should stay there, and he would do so if he was offered sufficient inducement. It was the men that were not so suited to the laboratory that should be moved not up but down to the administrative posts. In other words, it should not be necessary for a chemist to forsake his own calling to obtain a lucrative position.

A New Type of Accumulator

OWING to the wide use of electricity in small scale research work, as in electrometric analysis, electrolysis, and electrical precipitation of particles from gases, etc., the accumulator is an important factor in laboratory equipment, especially where bulk electricity is not available, or is unsuited to the small quantities required for these purposes. A new accumulator, described in a booklet issued by the Tungstone Accumulator Co., of 3, St. Bride's House, Salisbury Square, London, claims certain interesting advantages over the usual types, attributed to an improved method of construction. The patented basis of the Tungstone accumulator is a grid unit of pure lead die cast under high pressure with a supporting bracing frame of acid-resisting metal or wood. The fundamental principles of Planté, Faure and Swan are embodied, but whereas up to the present time accumulator plates have been hand-pasted, Tungstone, Ltd., have introduced die-casting into their construction. This improvement claims to produce better results than hitherto obtainable.

By die-casting, however, pure lead-oxide paste is forced evenly into the lead grid and in course of usage becomes naturally and homogeneously united with it, giving the highest possible electrical capacity. Sulphonation troubles are also reduced to a minimum. Machine made plates permit charge and discharge at continuous high rates with safety and no danger of fire or explosion when charging above normal rates. The plates, it is further claimed, will not buckle. The standard 12 volt car starting, lighting and ignition battery has 2 volt L.T. cells which are interchangeable for wireless, use in the laboratory, etc., and can be recharged on the car. The Tungstone container is seamless, this feature eliminating leaking.

Eiffel Tower Needs Rust-Resisting Products

ENGINEERS have just completed a detailed examination of the Eiffel Tower for rust damage, for when it was originally built in 1889 the tower was protected by three layers of a special mixture of red lead and pure linseed oil over which a thick coat of paint was laid. Within two years, however, rust was spreading. Badly rusted parts were scraped and covered with a coat of white lead, linseed oil and ochre, and since then the tower has been recoated four times with paint and various rust-resisting products. The last repainting was done in 1924, but rust is still eating into the metal in many places. Experts are now experimenting in the hope of finding a more effective protection which is weatherproof and a non-conductor of electricity.

Sir Max Muspratt Reviews 1925

Sulphuric Acid Difficulties

The year just passed has not been an easy one in the chemical industry, writes Sir Max Muspratt in the annual commercial supplement of the *Liverpool Post*. Large modern plants require steady loads for their best working, and, for various reasons, demand, especially in the overseas markets, has been subject to sudden and embarrassing changes.

On the alkali side there has been a steady improvement at home, which bears out the conclusions of most trained observers that, with certain well-known exceptions, there has been a distinct revival of industry at home. The export trade has, however, had a setback, notably in China, where the various civil wars have at last really upset business. Competition overseas from other countries has not been great in volume, but it has been very widespread and has reduced prices out of all proportion to its volume. One is forced to the conclusion that the stabilisation of the pound sterling, whatever advantage it may have in other directions, has contributed to this result.

In sulphuric acid the year has been one of supreme difficulty. The grave depression in the iron and steel industry, with the consequent closing down of coke ovens, and the desperate condition of the superphosphate industry, owing to fierce competition from low-exchange countries, have seriously damaged the sulphuric acid industry, as they are both large consumers. In addition, the otherwise desirable development of the zinc industry has thrown large quantities of by-product acid on a painfully restricted market.

Ammonium sulphate, on the other hand, has been buoyant at lower prices, and the successful synthetic process at Billingham has readily placed its existing production. Tar products seem to have had a satisfactory year, though the quantities must have been reduced by the shutting down of coke ovens.

In the dye industry the outstanding factor has been the reorganisation of the management and capital of the British Dyestuffs Corporation. The appointment of Dr. E. F. Armstrong has inspired general confidence. The fine chemical industry has continued to make progress under the much-discussed Safeguarding Act.

Artificial Silk

Great interest has been taken in recent months in artificial silk, which is primarily a chemical industry, although hitherto classified as a textile industry. Courtaulds, Ltd., have built up a great industry, of which the whole empire should be proud; but it is felt in the textile industry that the field of development in this and other artificial fibres is so great that there is room for others, and several schemes are in preparation. Another semi-chemical industry of interest is that of beet sugar, but it is still a little early to include this in a chemical survey.

A Disappointing Year

The Chemical and Allied Trades Section of the Manchester Chamber of Commerce presented its annual report on Friday, January 15, which stated that the chemical trade during 1925 was extremely disappointing, but it experienced, as in previous years, patches of short-lived activity. Many home consumers of heavy chemicals, such as alkali, bleach and caustic soda, etc., have renewed their contracts as usual, but the unsettled state of trade largely operates against this practice becoming general as in pre-war days, and it cannot be expected that this former custom will be revived until the consumers raise their output to above the 50–60 per cent. production point. Taken on the whole, prices are to-day on a slightly lower level than they were at the commencement of the year. Saltcake, contrary to expectations, closed at a considerably lower figure than the starting-point.

Mr. J. Allan was elected chairman of the section, Mr. T. H. Grant vice-chairman, and Mr. F. P. Bayley honorary secretary.

Seed, Oil and Cake Industry

Mr. F. W. Kielberg, president of the Liverpool Seed, Oil and Cake Trade Association, writing on those industries, says that it has required careful and efficient management to make both ends meet. Liverpool is fortunate in having some of the most efficient seed crushing mills in the world and 1926 could be looked to to bring expanding trade and returning prosperity.

B.D.H. Fine Chemical Products

The 1926 catalogue of B.D.H. fine chemical products, issued by the British Drug Houses, Ltd., London, has already attained a bulk that in itself speaks of rapid expansion. The list covers 104 pages, and includes organic and inorganic chemicals, analytical and other classes of reagents, volumetric solutions, chemicals for standardising purposes, indicators, microscopic stains, aniline dyes, minerals, etc., with prices and information as to qualities. It is stated that chemicals supplied under the firm's trade mark are of guaranteed purity, and that analytical data, including melting points, boiling ranges, and other purity criteria of organic substances, are supplied on request.

With respect to the *B.D.H. Book of A.R. Standards*, shortly to be published, it is stated that in 1914 the firm undertook the manufacture of analytical reagents according to the specifications of the special committee appointed by the Institute of Chemistry and the Society of Public Analysts, and that for the past eleven years they have been supplying regularly not only the "A.R." chemicals, but also a very wide range of chemicals used for general scientific purposes, including research and teaching. Some years ago proposals were made to the Council of the Institute of Chemistry that they should re-issue the *List of Reagents for Analytical Purposes* prepared in 1914, and that opportunity should be taken to revise some of the monographs, and to add to the number. It was decided, however, that the Institute should not undertake the task. Believing that there is a need for a work of reference of this character, the *B.D.H. Book of A.R. Standards* has been written for the purpose of defining as exactly as possible the commercially attainable standards for the purity of chemicals used for those scientific purposes for which purity is of great importance. The book will contain in all 157 monographs and embrace those 88 substances for which standards were given in the volume published by the Council of the Institute of Chemistry. Additional tests have been made in respect of the substances dealt with in that publication, and in many instances it has been possible to take advantage of much experience gained over an extended period of time to give greater precision to the limits and tests laid down.

Nichols Medal for Dr. S. C. Lind

The Nichols Medal in Chemistry for 1925 has been awarded by the New York Section of the American Chemical Society to Dr. Samuel Colville Lind, Associate Director of the U.S. Fixed Nitrogen Research Laboratory, Washington, who is internationally known as a worker in the sources of radium.

The medal specifically recognises Dr. Lind's work on "the chemical activation of alpha particles." Dr. Lind has been engaged in research on carnotite deposits, the world sources of radium. He has been working on the effect of alpha rays, rays from radium, and on the progress of chemical reactions. In 1923 Dr. Lind was made chief chemist of the U.S. Bureau of Mines. He invented the Lind interchangeable electroscope for radium measurements and originated the ionisation theory of the chemical effects of radium rays.

Development of the Fixed Nitrogen Laboratory at Washington is regarded by chemists as an outstanding development of the post-war period. In the next decade, it is predicted, the United States will make great advances in the production of fixed nitrogen.

German Dye Combine Capital

It is reported from Berlin that the prospectus of the New German Dyes Trust and Nitre, which consists of a fusion of the companies formerly allied in the aniline group, shows plant valued at 312 million marks, stores 233 million marks, interests in other companies 204 million marks, moneys due 245 million marks, and cash and fluid means 68 million marks. The capital is understood to consist of 641 million marks ordinary shares and 4,400,000 marks preference shares, the latter equipped with 100-fold voting power. The reserves are 104 million marks and the debts total 214 million marks. The president of the directorate is Professor Bosch.

From Week to Week

SIR WILLIAM POPE has been elected an honorary member of the Rumanian Chemical Society.

MR. THEODORE SCHWARZ, F.I.C., has been appointed Vice-Consul of the Republic of Czecho-Slovakia for the northern part of Mexico.

THE SALE BY AUCTION of the British Carbide Factories, Ltd., Bank Street, Clayton, Manchester, will take place on Wednesday, January 27.

THE KYLE CHEMICAL WORKS, Irvine, will be visited by members of the Western District of the Scottish Junior Gas Association on January 30.

THE OPENING of a branch institute and laboratories for the exclusive use of non-German research workers by the well-known Kaiser Wilhelm Society is announced from Berlin.

MR. A. M. HOGARTH has been elected Chairman of the Panel of Applied Biology of the College of Pestology in the place of the late Professor Maxwell-Lefroy. Mr. S. S. Light is the new deputy chairman.

RECENT WILLS include the following: Mr. Andrew Arthur Rose, Edinburgh, formerly of Craig and Rose, paint and varnish manufacturers, £84,355; Alderman R. W. Oddy, F.I.C., F.C.S., analytical chemist, of Rochdale, £5,825.

LECTURING ON FUEL ECONOMY at Halifax on Friday, January 15, Dr. E. W. SMITH, F.I.C., said that it should be encouraged not by mere saving or doing without but by correct use. Properly directed research should be undertaken and continued in every direction.

AS THE RESULT OF REPRESENTATIONS, the Board of Trade announces that for the present licences will not be required for the importation of copying inks and other coloured pencils of synthetic organic origin. The same applies to boxes of synthetic organic paints of less than 6d. in value.

A NEW ROOFING MATERIAL is reported from Australia. The Anaconda Copper Co. have produced copper clad asphalt shingles For some time the electrolytic deposition of copper has been appreciated but apparently this is the first time the process has been commercially applied on non-metallic bases.

CONSIDERABLE FIRE DAMAGE occurred at the workshops and offices of the French Asphalte Co., Sugar House Lane, Stratford, on Friday, January 15. An oil store was saved.—A barrel of petrol exploded at an Oldham garage on Monday. The proprietor was seriously injured and the garage was destroyed.

SIR ALFRED MOND has left for Brussels for important business conferences. These conferences will detain him longer than was anticipated and his speech on "Co-partnership in Industry," which was to have been given at Newcastle on Saturday, before the Labour Co-partnership Association Conference, has been cancelled.

THE KING has consented to become patron of the Annual Meeting of the Society of Chemical Industry to be held in London during the week commencing Monday, July 19 next. At the opening meeting Earl Balfour will deliver the third Messel Memorial Lecture in the Mansion House, at which the Lord Mayor of London will preside.

ON THE APPLICATION of Mr. Clauson, K.C., Mr. Justice Tomlin, in the Chancery Division, on Tuesday, fixed Tuesday, March 2, for the trial of the action of the Salt Union *v.* Bell Bros., Ltd., and Dorman Long and Co. Counsel stated that it was a very heavy case, involving the calling of a large number of expert and scientific witnesses, and must occupy the attention of the Court for a long time.

THE INSTITUTION OF FUEL ECONOMY ENGINEERS held its first council meeting in London on Friday, January 15. The first list of members was submitted. Applications came from leading engineers, associated with a wide selection of industries throughout the country. A London office is to be opened shortly. In the meantime applications should be sent to Mr. H. L. Pirie, 29, Sherwin Road, Lenton, Nottingham.

THE REALISATION OF LIVERPOOL'S SUITABILITY as an industrial centre was commented upon by Sir Max Muspratt on Monday. There was a new factory enterprise and in February a company which he was not at liberty to name would probably require another 500 workers. At an early date reasoned recommendations would be put to the railway companies and the Dock Board by the Committee on Trade of the Port showing where, in the opinion of the commercial community, Liverpool suffered handicaps and disadvantages in comparison with other ports.

PRESENTATIONS HAVE BEEN MADE to Mr. W. Collinson, managing director of W. Blythe and Co., chemical manufacturers, Church, by the directors and staff of the company. They consisted of a silver coffee service and salver and a silver rose bowl and silver candlesticks, and were made at a social function held by Mr. Collinson to mark the completion of his forty years' service with the company. Mr. Collinson remarked upon the excellent long service records of many employees. Seven had forty years' service and nearly sixty had over 20 years' service to their credit.

J. PRESTON, laboratory furnisher, of 105, Barker Pool, Sheffield, informs us that his address is now 208, West Street.

COLONEL SIR EDWARD BROTHERTON has given £2,000 to the fund for establishing a cancer research station in Yorkshire.

THE LLANELLY STEEL CO., LTD., is to erect a new sheet and galvanising works at Llanelly. Employment for several hundred will be found.

IMPORTANT NITRATE DEPOSITS are reported to have been discovered near the Arivalpa River, Arizona. They are said to be the first found in the United States.

DRS. G. T. MORGAN, C. Scott Garrett, and John Hawthorne have been appointed Examiners for National Certificates in Chemistry (Northern Ireland).

A CALENDAR IN COLOURS illustrating the uses of calcium cyanimide has been received from the Propaganda Division, Fertiliser Sales, Ltd., Adelaide House, King William Street, London, E.C.4.

THE PRIZE OF £30 from the Jordan Wigan Fund for research in chemistry has been awarded to Mr. F. H. Constable (St. John's) by Cambridge University for investigations on the nature of catalytic action.

THE BRITISH VISADA statutory report shows that the first unit is expected to be working by May and that the complete factory will produce 27,500 lb. of viscose silk per week. Sir Edward Stockton will make a statement at the meeting on Monday.

A £72,000 CONTRACT for gasworks plant from the Town Council of Aarhus, Denmark, has been awarded to the Woodall-Duckham Vertical Retort and Oven Construction Co. (1920), Ltd., against close foreign competition, including three German tenders.

A REPRESENTATIVE CONFERENCE of the British glass industry was held at Birmingham last week. It was decided to make further application for protection against foreign competition. The The necessity of chemical and scientific glassware in war was pointed out.

THE FOLLOWING OFFICERS WERE ELECTED at the annual meeting of the Sheffield Metallurgical Association last week:—President, Mr. T. G. Elliot, F.I.C.; vice-presidents, Messrs. T. Swinden, F. M. Parkin, T. P. Colclough, and J. H. G. Monypenny; honorary secretary, Mr. W. E. Rowntree.

THOSE INTERESTED IN TRADE with Belgium should note that the Commercial Secretary at Brussels will attend the Department of Overseas Trade up to January 29 to meet and advise U.K. manufacturers and merchants: appointments arranged on application to the D.O.T., 35, Old Queen Street, reference 16,056.

AN APPEAL FOR A MEMORIAL to James Prescott Joule in his native town of Salford was made by Professor W. W. H. Gee at Salford on Friday, January 15. Joule's research on the measuring of the mechanical equivalent of heat, his discovery of electric welding and his extensive published research were referred to. A scholarship at the Royal Technical College was suggested.

TETRAETHYL LEAD, which is being investigated by a U.S. Government Committee, is expected to be reported on this month. If its use is approved production will be undertaken all over the world and large demands will be made for bromine, and it is suggested that ships similar to the "Ethyl" will be used to displace bromine in sea water by means of chlorine. The call for chlorine will also probably affect the caustic soda market and prices.

SUGAR BEET DEVELOPMENTS are reported. No sugar is to be made at the Spalding factory this season. The Anglo-Scottish Beet Sugar Corporation is handicapped by lack of water for refining purposes. They are asking Spalding Council for a million galls. per day by September 1.—Mr. J. D. Coleman, speaking at Norwich on Saturday, January 16, said that a new factory was to be erected to work the de Vicchis process. This Italian process, invented by Dr. de Vicchis, is claimed to be particularly economical and efficient. Sir Charles Cottier has presented the British rights in the process to the Government and is to form a company. Various laboratory research into this process is being conducted at Oxford University, following the Mission Inquiry which studied the process in Italy. Dr. Owen, of the Agricultural Research and Engineering Institute, who went on the Mission, is superintending the research.

Obituary

MR. ARTHUR JACKSON, director of F. Steiner and Co., calico printers, Manchester, aged 75.

MR. W. E. SMITH, managing director of Smith and Spencer, mineral water manufacturers, Redditch and Bromsgrove, aged 75.

MR. JOSEPH HENRY HOLLYER, J.P., at Droitwich, for many years identified with the Corbett Estate and the salt industry and formerly at the Stoke Prior Salt Works.

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RUBBER.—Rate of combination of sulphur with rubber in hard rubber. W. E. Glancy, D. D. Wright, and K. H. Oon. *J. Ind. Eng. Chem.*, January, 1926, pp. 73–75.

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REACTIONS.—Action of pyridine solutions of benzoin and aromatic aldehydes on metallic copper. H. Mohler. *Helv. Chim. Acta.*, December, 1925, pp. 740–757.

The reaction between cupric copper and iodide and between cuprous iodide and iodine. I. M. Kolthoff. *Rec. Trav. Chim. Pays-Bas*, January, 1926, pp. 153–161.

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Patent Literature

The following information is prepared from published Patent Specifications and from the Illustrated Official Journal (Patents) by permission of the Controller to H.M. Stationery Office. Printed copies of full Patent Specifications accepted may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, at 1s. each

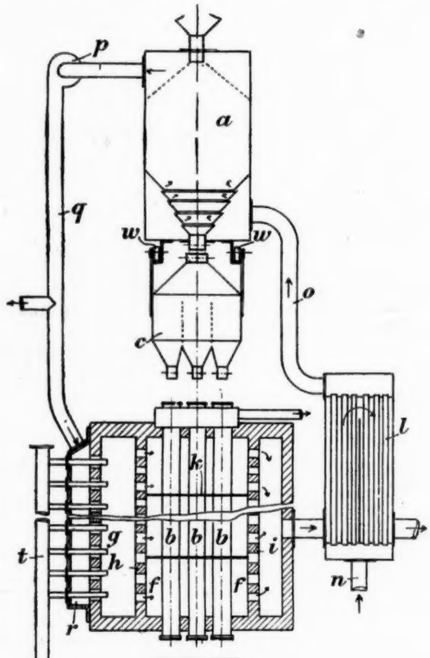
Abstracts of Complete Specifications

244,372. ELECTRICAL GAS PURIFICATION, PROCESS FOR. Lodge-Cottrell, Ltd., 51, Great Charles Street, and Church Street, Birmingham. From Metallbank und Metallurgische Ges. Akt.-Ges., 45, Bockenheimer Anlage, Frankfurt-on-Main, Germany. Application date, August 29, 1925. Addition to 177,117 as modified by 238,480.

The gas to be purified has been cooled before entering the field of the electrical gas purifier down to or below its dew point, and then reheated in such a manner as to prevent ionisation. The gas may be subjected to a preliminary electrical cleaning before cooling down to or below the dew point. In the present invention, the gas after subjection to electrical precipitation and before de-ionisation by cooling is passed directly without reheating into the electrical fine cleaner. In this case, the moisture resulting from the spray cleaning process is deposited on the collecting electrodes with the dust.

244,337. COKE, GAS, AND TAR FROM SOLID FUEL, PROCESS AND APPARATUS FOR PRODUCING. J. Rude, 27, Clanricarde Gardens, London, W.2. Application date, May 11, 1925.

This apparatus is a development of that described in Specification No. 204,718 (see THE CHEMICAL AGE, Vol. IX, p. 611) in which fuel is carbonised in two stages in an internally heated low-temperature retort, and in an externally heated high-temperature retort. The fuel passes downwards from the internally heated retort *a* to an intermediate chamber *c* suspended on runners *w*, so that the fuel can be distributed to various groups of externally heated retorts *b*. The heating flues *f* of the retorts *b* are provided with horizontal baffles *k*, and combustion gases pass from the chamber *g* through the perforated wall *h* into these flues. The combustion gases pass through another perforated wall *i* to a heat interchanger *l* to which air or other gas passes by a pipe *n*. The heated air passes by a pipe *o* to the preheater *a*. The air and combustible gas pass through a fan *p* and pipe *q* to a distributing chamber *r*, where the gas meets the fuel gas supplied from a pipe *t*. The fuel is heated in the retort *a* to a temperature below that at which the plastic state commences, so that the resistance to the passage of the heating gas is low. Very little gas and tar are liberated in this retort, so that air may be employed for heating without danger of igniting the fuel, and the air may then be used immediately for combustion purposes.



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243,768. POLYMERISED STYROL, MANUFACTURE OF. The Naugatuck Chemical Co., Elm Street, Naugatuck, Conn., U.S.A. Assignees of I. Ostromislensky and W. A. Gibbons, 561, West 58th Street, New York. International Convention date, May 7, 1924.

This process is for producing vitreous polymerised styrol, more particularly from a solution of styrol in an organic solvent. The product is tough, colourless, and transparent, has a relatively high melting point, and can be cut with a knife; it is distinguished from resinous styrol which has a relatively low melting point and is brittle. It has been found that at certain concentrations of styrol in a solvent, there is a temperature at or below which the mixture may be polymerised to yield the vitreous product. Thus the product obtained as described in Specification No. 232,909 (see THE CHEMICAL AGE, Vol. XIII, p. 18) is mixed with a polymerisation retarder which has 1 per cent. of trinitrobenzol or quinone, and is fractionally distilled to produce three fractions, the first two at atmospheric pressure and the third in vacuo. The first fraction passes over up to 132° C., the second between 132° and 133·8° C., and the third up to 65·3° C. in a vacuum of 24 mm. The first fraction contains about 3 per cent. of unpolymerised styrol, the second about 12–15 per cent., and the third about 50 per cent. The material other than styrol in the second fraction depends on the initial material used, *e.g.*, if ethyl benzol was the initial material it will present in the second fraction. The third fraction will contain xylol and other hydrocarbons in addition. The third fraction is heated under a reflux condenser to 135°–140° C. to polymerise the styrol. To recover the vitreous product, the mixture is first evaporated at ordinary temperature in vacuo, and the temperature is raised to 130° C. A solution containing 84 per cent. of styrol should be polymerised at 175° C., and a solution containing 95 per cent. of styrol should be polymerised at 200° C. Instead of evaporating to obtain the vitreous styrol, it may be precipitated by adding ethyl alcohol and then dissolving in benzol and reprecipitating in alcohol. Part of the heating to effect polymerisation may be done without refluxing so that polymerisation and evaporation proceed simultaneously.

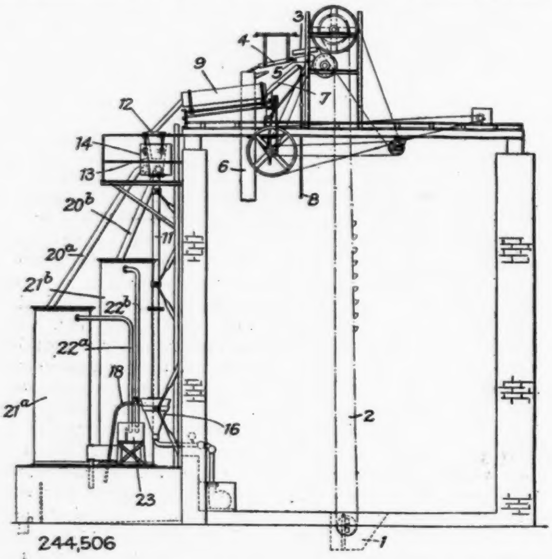
244,035. CC-SUBSTITUTED COMPOUNDS OF BARBITURIC ACID and 4-DI-METHYLAMINO-2 : 3-DIMETHYL-1-PHENYL-5-PYRAZOLONE, PROCESS OF MANUFACTURE OF. P. Pfeiffer, 98, Meckenheimer Allee, Bonn-on-Rhine, Germany. International Convention date, December 3, 1924. Addition to 231,512.

Specification No. 231,512 (see THE CHEMICAL AGE, Vol. XII, p. 590) describes the preparation of a new compound from diethyl-barbituric acid and 4-dimethyl-amino-2 : 3-dimethyl-1-phenyl-5-pyrazolone by evaporating a solution containing the latter in excess to obtain a highly concentrated solution which is allowed to cool, or alternatively by treating the components with a small quantity of warm water until a solution is obtained. In this invention, examples are given of the application of this process to other CC-substituted barbituric acids, and 4-dimethyl-amino-2 : 3-dimethyl-1-phenyl-5-pyrazolone. Thus isopropyl propenyl-barbituric acid yields a compound melting at 95°–97° C., and soluble in alcohol, ether, and benzene; phenylethyl barbituric acid yields a compound melting at 129°–131° C., and also soluble in alcohol, ether, and benzene.

244,506. NATURAL BASE EXCHANGE ZEOLITE-LIKE MATERIALS. E. B. Higgins, Imperial House, Kingsway, London, W.C.2. Application date, September 10, 1924.

This process is for treating natural base exchange materials employed in water softening—*e.g.*, glauconite (greensand). This mineral occurs in grains of various sizes, only the coarse constituents being employed for base exchange, and some clay or marl is always present. This process is for separating the clay-like constituents and the finer grains. The clay is retained by the glauconite with great tenacity if purification is attempted by washing with water, and in this invention the material is subjected to a peptising and hydraulic grading process in a column of upwardly flowing slightly alkaline solution such as a solution of caustic soda containing 0·5–1 lb. of caustic soda per ton of water.

The glauconite is raised from a pit 1 by a bucket elevator 2, and transferred to a tray 3 and thence to a shaker screen 4



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oscillated by a crank 5. The coarse refuse passes into a shoot 6, and the remainder passes through the screen to a shoot 7. The peptising solution passes through a pipe 8 into a rotating tubular mixer 9 in which the solid material is treated. The strength of the alkaline solution employed varies with the raw material, and must be determined by a preliminary experiment. The wet material passes into a vertical pipe 11 surrounded by two vertical cones 12, 13, the former of which is adjustable vertically. A steady upward flow of water is maintained in the pipe 11 at a velocity of 1·75 centimetres per second. All the clay and finer particles are carried upwards with the water, and overflow the cone 13 into the tank 14. The coarser material passes downward to a vessel 16 and outlet pipe 18. The water and lighter constituents pass through pipes 20a, 20b to two receptacles 21a, 21b, alternately. Most of the fine material is left in these receptacles, but some passes with the water through pipes 22a, 22b to a tank 23. The coarser material separated may be introduced into a column of water or alkaline solution moving upwards at a speed of 16 centimetres per second. The heavy particles which have no base exchange properties sink downwards and can be removed. The active material can be subjected to further treatment with water at intermediate speeds to grade it, and several arrangements of apparatus for this purpose are described.

244,526. SOLUTIONS CONTAINING ALKALI OXYSALT OF TIN, TREATMENT OF. H. Harris, 54, New Broad Street, London, E.C.3. Application date, September 18, 1924.

This process is more particularly for the recovery of tin from caustic soda solutions containing oxysalts and arsenic, derived from the purification of lead by means of caustic soda and sodium chloride. In a purification process in which molten lead is circulated through molten caustic soda and salt, the tin, arsenic, and antimony can be removed in the form of oxysalts. According to Specification No. 213,638 (see THE CHEMICAL AGE, Vol. X, p. 495) it has been found that calcium carbonate will precipitate tin from its sodium oxysalt in the presence of oxysalt of arsenic, without precipitating the latter. It is now found that calcareous matter, especially calcium hydrate, which usually precipitates arsenic from arsenates, does not do so in the presence of carbon dioxide or carbonates. Tin may therefore be separated from such solutions by adding sodium carbonate and calcium hydrate in succession.

NOTE.—Abstracts of the following specifications which are now accepted, appeared in THE CHEMICAL AGE when they became open to inspection under the International Convention: 222,125 (Farbwerke vorm. Meister, Lucius, and Brüning), relating to condensation products of the anthraquinone series, see Vol. XI, p. 531; 233,649 (Naugatuck Chemical Co.), relating to polymerised styrol and its homologues, see Vol. XIII, p. 43; 238,900 (Rochlingsche Eisen und Stahlwerke Akt.-Ges.), relating to production of hydrated products of olefines, see Vol. XIII, p. 454.

International Specifications not yet Accepted

242,650. PHOSPHORIC ACID. W. Kyber, 10, Liliencronstrasse, Steglitz, Berlin. Assignee of E. Britzke, 27, Bolschoi Afansjewsky, Pereulok Quartier 8, Moscow. International Convention date, November 7, 1924.

Phosphorites are treated with silicates and carbon in a shaft furnace to obtain phosphoric acid, and the elemental phosphorus in the gas is oxidised by air or oxygen at 1,000°–1,300° C. The carbon monoxide is thus not oxidised, and after removal of the phosphoric acid it may be used as generator gas.

242,659. ACTIVE CARBON. Naamlooze Vennootschap Algemeene Norit Maatschappij, 2, den Texstraat, Amsterdam. Assignees of J. N. A. Sauer, 2, den Texstraat, Amsterdam. International Convention date, November 8, 1924.

In making activated carbon from raw or predistilled carbonaceous material the activating gases are supplied, with or without heating gases, transversely to the axis of the retort, and then pass through the retort in the same or the opposite direction to that of the carbonaceous material. The activating gases may be steam, air, oxygen, carbon dioxide, combustion products, ammonia, chlorine, hydrochloric acid, vaporised chlorides, and combustible gases. Mineral constituents may be removed by using sulphur dioxide or hydrofluoric acid. Several examples of suitable retorts are described.

242,669. ORGANO-MERCURY COMPOUNDS. Farbenfabriken vorm. F. Bayer & Co., Leverkusen, near Cologne, Germany. International Convention date, November 10, 1924.

A solution of mercuric sulphate in sulphuric acid is slowly run into a hot solution of *o*-nitrophenol or a halogen- or halogen-nitrophenol. The quantity of nitrophenol is such that the mixture is acid only when decomposition is complete. The product is mercury-*o*-nitrophenol.

242,974. PHENOL SULPHUR COMPOUNDS. Akt.-Ges. für Anilin Fabrikation, Treptow, Berlin. International Convention date, November 14, 1924. Addition to 232,958.

To obtain colourless mordants for basic dyestuffs, a resinous body prepared from a phenol and sulphur chloride is sulphonated with strong sulphuric acid at 90°–100° C. and the product condensed with excess of phenol at a temperature rising to 210°–220° C. The excess of phenol is expelled in vacuo at 240° C. See also Patent No. 232,958.

242,975. AMMONIUM, ALKALI, AND ALKALINE EARTH SALTS. Farbwerke vorm. Meister, Lucius, and Brüning, Hoechst-on-Main, Germany. International Convention date, November 17, 1924.

A mixture of coarse grained sodium nitrate having a specific gravity 2·3, and fine grained ammonium chloride having a specific gravity 1·5 is obtained by double decomposition in a mother liquor containing sodium nitrate, ammonium chloride, and ammonium nitrate having a specific gravity 1·4. The mixture is separated by an elutriating process, in which the lighter ammoniun chloride flows into a settling tank and is separated from the mother liquor.

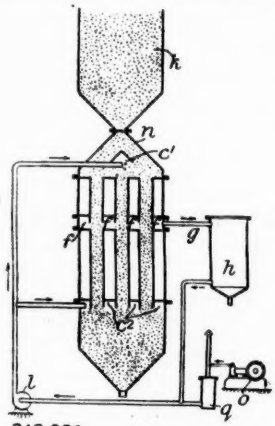
242,990. CALCIUM NITRATE. Farbwerke vorm. Meister, Lucius, and Brüning, Hoechst-on-Main, Germany. International Convention date, November 11, 1924.

A 75 per cent. solution of calcium nitrate is calcined and

almost completely dehydrated. It is then transferred to a cooler and mixer, and when cold a small proportion of calcium nitrate crystals is added. In these circumstances the calcium nitrate obtained does not readily become moist.

242,986. REACTIVATING ADSORPTION MEDIA. Metallbank und Metallurgische Ges. Akt.-Ges., 45, Bockenheimer Anlage, Frankfort-on-Main, Germany. International Convention date, November 12, 1924.

Activated carbon, gels, etc., are reactivated by heating, and the gases set free are removed before coming into contact



242,986

with the adjacent cooler adsorption medium. The removal of the gases may be facilitated by scavenging gases. A single vessel may be used for the adsorption and regeneration, and may be provided with gas collecting chambers embedded in the medium at different points and connected by pipes to an external condenser. Alternatively the medium may be passed continuously or intermittently through the regenerating chamber, which is surrounded by a heating jacket. Scavenging gases may be introduced into the gas collecting chambers and the liberated gases drawn off to separate condensers, corresponding to fractions of different boiling points.

In the apparatus illustrated, the scavenging agent is recovered and used again. The adsorption medium passes from a hopper *k* into the regenerating device, consisting of tubes arranged in a heating chamber. The liberated gases rise into collecting chambers *f* and then pass through a pipe *g* to a condenser *h*. The scavenging gas may be generated in an internal combustion engine *o* and introduced by a blower *l* into the system. The scavenging gas recovered from the condenser *h* is returned to the system. The internal combustion engine provides the power required in the system.

242,996. BARIUM AND STRONTIUM HYDROXIDES AND SALTS. F. Rothe, 51, Wilhelmstrasse, Aachen, and H. Brenek, 192, Hauptstrasse, Porz, near Cologne, Germany. International Convention date, November 12, 1924.

Barium or strontium sulphate is heated with silica or barium or strontium metasilicate obtained as a by-product in this process. Silicates are obtained having a composition between $Ba_2 SiO_4$ and $Ba_3 SiO_5$ or $Sr_2 SiO_4$ and $Sr_3 SiO_5$ respectively. These may be converted into the corresponding chlorides or nitrates by treating with hydrochloric or nitric acid, or they may be converted into the hydroxides by treating with water, leaving a residue of barium or strontium metasilicate which is used again.

LATEST NOTIFICATIONS.

245,723. Process of protecting metals and alloys against corrosion. Metallbank und Metallurgische Ges. Akt.-Ges. January 9, 1925.

245,745. Method of and apparatus for bleaching fatty oils, mineral oils, and the like. Bollmann, H. January 6, 1925.

245,758. Process for the production of azo dyestuffs for dyeing cellulose esters, especially cellulose acetate. Chemical Works (formerly Sandoz). January 6, 1925.

245,759. Process for increasing the affinity of animal fibres for dyestuffs. Chemical Works (formerly Sandoz). January 6, 1925.

245,762. Process for the manufacture of metallic nitrides and ammonia. Soc. d'Etudes Minières and Industrielles. January 8, 1925.

245,765. Manufacture of new azo-dyestuffs. I. G. Farbenindustrie Akt.-Ges. January 8, 1925.

245,770. Processes for washing coals and ores and the like. Clouwez, C. January 9, 1925.

245,774. Presses of the continuous type for the extraction of oil from oleaginous and like grains or seeds. Soc. Anon. des Etablissements A. Olier. January 8, 1925.

245,785. Process for the production of potash glass. I. G. Farbenindustrie Akt.-Ges. January 8, 1925.

245,790. Process of dyeing cellulose esters and ethers. I. G. Farbenindustrie Akt.-Ges. January 9, 1925.

Specifications Accepted with Date of Application

222,481. Hydrocarbons, Purification of. T. T. Gray. September 26, 1923.

228,103. Tin from alloys containing iron, Process for the production of. F. Wüst. September 15, 1924.

228,129. Cements and combustible gas, Process for the simultaneous production of. Gewerkschaft Lutz III. January 22, 1924.

231,455. Acetylcellulose, Process for producing fast tints or shades on. Soc. of Chemical Industry in Basle, March 31, 1924.

232,263. Vat dyes, Process of manufacturing. H. Pereira. April 10, 1924.

237,573. Keten, Method of manufacturing. Ketoid Co. July 22, 1924.

237,615–6. Complex salts of hydrofluoric acids, Process of producing. A. F. Meyerhofer. December 20, 1923. Additions to 226,490.

241,588. Metal compounds, Process of producing. A. F. Meyerhofer. December 20, 1923.

245,352. Permanent emulsions, Manufacture of. Soc. of Chemical Industry in Basle. June 11, 1925. Addition to 200,036.

245,177. Rubber emulsions, Method of concentrating or coagulating. Anode Rubber Co., Ltd. (*P. Klein and A. Szegvari.*) July 31, 1924.

245,190. Carbonisation of fuel, Apparatus for use in. S. R. Illingworth, Illingworth Carbonisation Co., Ltd.; R. Dempster and Sons, Ltd., and H. J. Toogood. September 25, 1924.

245,223. Iron and steel, Process for the direct production of. R. H. M. L. Tournie. October 13, 1924.

245,287. Azo-dyestuffs, Manufacture of. O. Y. Imray. (*Farbwerke vorm. Meister, Lucius, and Brüning.*) January 24, 1925.

Applications for Patents

British Dyestuffs Corporation, Ltd., Bunbury, H. M., Shepherdson A., and Tatum, W. W. Manufacture of anthraquinone intermediates. 788, 789, 790. January 11.

Bromley, T. C., Green, C. H., and Mellor, Bromley and Co., Ltd. Dyeing, washing, etc., apparatus. 869. January 12.

Buchner, M. Production of soluble salts of organic compounds. 917. January 12. (Germany, January 16, 1925.)

Coley, H. E. Apparatus for reduction of ores, etc. 930. January 12.

Cox, K., and McDermott, P. J. Purification of benzol, petrol, etc. 902. January 12.

Disney, J. H., and Kernot, J. C. Emulsifying agents. 1,237. January 15.

Dreaper, W. P. Manufacture of artificial silk, etc. 747. January 11.

Dreaper, W. P. Filtering apparatus for artificial silk production, etc. 859. January 12.

Du Pont de Nemours and Co., E. I., and Marks, E. C. R. Compositions containing organic mercury compounds. 904. January 12.

Gordon, A. Recovery and refining of precious metals. 806. January 11.

Heyl, G. E. Distillation apparatus. 853. January 12.

Höhn, F. Production of a chloride. 779. January 11.

I. G. Farbenindustrie Akt.-Ges and Johnson, J. Y. Manufacture of iron carbonyl. 782. January 11.

I. G. Farbenindustrie Akt.-Ges. and Johnson, J. Y. Manufacture of alkyl formates. 783. January 11.

I. G. Farbenindustrie Akt.-Ges. and Johnson, J. Y. Manufacture of benzanthrone derivatives. 1,013. January 13.

Lilienfeld, L. Manufacture of artificial materials from viscose. 802. January 11.

Olsen, O. R., and Torkildsen, E. Manufacture of phosphatic fertilisers. 814. January 11.

Soc. l'Air Liquide Soc. Anon. pour l'Etude et l'Exploitation des Procédés G. Claude. Process for production of products rich in hydrogen, etc. 1,330. January 16. (France, January 17, 1925.)

Soc. of Chemical Industry in Basle. Manufacture of a thioindoxyl derivative. 1,144. January 14. (Switzerland, January 14, 1925.)

Techno-Chemical Laboratories, Ltd. Extraction of substances from liquids. 1,317. January 16.

Weekly Prices of British Chemical Products

The prices and comments given below respecting British chemical products are based on direct information supplied by the British manufacturers concerned. Unless otherwise qualified, the figures quoted apply to fair quantities, net and naked at makers' works.

General Heavy Chemicals

ACID ACETIC, 40% TECH.—£19 per ton.
ACID BORIC, COMMERCIAL.—Crystal, £40 per ton, Powder, £42 per ton.
ACID HYDROCHLORIC.—3s. 9d. to 6s. per carboy d/d, according to purity, strength, and locality.
ACID NITRIC, 80° Tw.—£21 10s. to £27 per ton, makers' works, according to district and quality.
ACID SULPHURIC.—Average National prices f.o.r. makers' works, with slight variations up and down owing to local considerations; 140° Tw., Crude Acid, 60s. per ton. 168° Tw., Arsenical, £5 10s. per ton. 168° Tw., Non-arsenical, £6 15s. per ton.
AMMONIA ALKALI.—£6 15s. per ton f.o.r. Special terms for contracts.
BLEACHING POWDER.—Spot, £9 10s. d/d; Contract, £8 10s. d/d, 4 ton lots.
BISULPHITE OF LIME.—£7 10s. per ton, packages extra, returnable.
BORAX, COMMERCIAL.—Crystal, £25 per ton. Powder, £26 per ton. (Packed in 2-cwt. bags, carriage paid any station in Great Britain.)
CALCIUM CHLORATE (SOLID).—£5 12s. 6d. to £5 17s. 6d. per ton d/d, carr. paid.
COPPER SULPHATE.—£25 to £25 10s. per ton.
METHYLATED SPIRIT 64 O.P.—Industrial, 2s. 5d. to 2s. 11d. per gall. Mineralised, 3s. 8d. to 4s. per gall., in each case according to quantity.
NICKEL SULPHATE.—£38 per ton d/d.
NICKEL AMMONIA SULPHATE.—£38 per ton d/d.
POTASH CAUSTIC.—£30 to £33 per ton.
POTASSIUM BICHROMATE.—4½d. per lb.
POTASSIUM CHLORATE.—3⅞d. per lb., ex wharf, London, in cwt. kegs.
SALAMMONIAC.—£45 to £50 per ton d/d. Chloride of ammonia, £37 to £45 per ton, carr. paid.
SALT CAKE.—£3 15s. to £4 per ton d/d. In bulk.
SODA CAUSTIC, SOLID.—Spot lots delivered, £15 2s. 6d. to £18 per ton, according to strength; 20s. less for contracts.
SODA CRYSTALS.—£5 to £5 5s. per ton ex railway depots or ports.
SODIUM ACETATE 97/98%.—£21 per ton.
SODIUM BICARBONATE.—£10 10s. per ton, carr. paid.
SODIUM BICHROMATE.—3½d. per lb.
SODIUM BISULPHITE POWDER 60/62%.—£17 per ton for home market, 1-cwt. iron drums included.
SODIUM CHLORATE.—3d. per lb.
SODIUM NITRITE, 100% BASIS.—£27 per ton d/d.
SODIUM PHOSPHATE.—£14 per ton, f.o.r. London, casks free.
SODIUM SULPHATE (GLAUBER SALTS).—£3 12s. 6d. per ton.
SODIUM SULPHIDE CONC. SOLID, 60/65.—£13 5s. per ton d/d. Contract, £13. Carr. paid.
SODIUM SULPHIDE CRYSTALS.—Spot, £8 12s. 6d. per ton d/d. Contract, £8 10s. Carr. paid.
SODIUM SULPHITE, PEA CRYSTALS.—£14 per ton f.o.r. London, 1-cwt. kegs included.

Coal Tar Products

ACID CARBOLIC CRYSTALS.—4¾d. to 5d. per lb. Crude 60's, 1s. 3½d to 1s. 6d. Better demand
ACID CRESYLIC 97/99.—1s. 8d. to 1s. 10d. per gall. Pale, 95%. 1s. 6d. to 1s. 9d. per gall. Dark, 1s. 3d. to 1s. 4d. per gall. Good demand.
ANTHRACENE.—A quality, 3d. to 4d. per unit; Paste 40%, 3d. per unit per cwt. Nominal price.
ANTHRACENE OIL, STRAINED.—7d. to 8½d. per gall. Unstrained, 7d. per gall.
BENZOL.—Crude 65's, 1s. 2½d. to 1s. 3d. per gall., ex works in tank wagons. Standard Motor, 1s. 8d. to 1s. 10d. per gall., ex works in tank wagons. Pure, 1s. 11d. to 2s. 3d. per gall., ex works in tank wagons.
TOLUOL.—90%, 1s. 9½d. to 2s. per gall. Pure, 1s. 11d. to 2s. 3d. per gall.
XYLOL COMMERCIAL.—1s. 11d. to 2s. 3d. per gall. Pure, 2s. 2d. to 3s. 3d. per gall.
CREOSOTE.—Cresylic, 20/24%, 8½d. to 10d. per gall. Market very quiet. Standard specification, 6½d. to 7½d. per gall.; middle oil, heavy, 6½d. to 7d. per gall. Market steady.
NAPHTHA.—Crude, 9d. to 1s. per gall. Solvent 90/160, 1s. 6d. to 1s. 10d. per gall. Fair business. Solvent 90/190, 1s. to 1s. 5d per gall. Steady demand.
NAPHTHALENE CRUDE.—Drained Creosote Salts, £3 10s. to £5 15s. per ton. Whizzed or hot pressed, £5 10s. to £7 10s.
NAPHTHALENE.—Crystals and Flaked, £11 10s. to £13 per ton, according to districts.
PITCH.—Medium soft, 55s. to 59s. per ton, according to district. Market active.
PYRIDINE.—90/160, 17s. 9d. to 20s. per gall. Firmer. Heavy, 7s. to 10s. per gall. More inquiry.

Intermediates and Dyes

In the following list of Intermediates delivered prices include packages except where otherwise stated.
ACETIC ANHYDRIDE 95%.—1s. 7d. per lb.
ACID AMIDONAPHTHOL DISULPHO (1-8-2-4).—10s. 9d. per lb.
ACID ANTHRANILIC.—7s. per lb. 100%.
ACID BENZOIC.—1s. 9d. per lb.
ACID GAMMA.—9s. per lb.
ACID H.—3s. 3d. to 3s. 6d. per lb. 100% basis d/d.
ACID NAPHTHIONIC.—2s. 2d. per lb. 100% basis d/d.
ACID NEVILLE AND WINTHER.—4s. 9d. to 4s. 10d. per lb. 100% basis d/d.
ACID SULPHANILIC.—9d. per lb. 100% basis d/d.
ALUMINIUM CHLORIDE, ANHYDROUS.—10d. per lb. d/d.
ANILINE OIL.—7d. to 7½d. per lb. naked at works.
ANILINE SALTS.—7d. to 8d. per lb. naked at works.
ANTIMONY PENTACHLORIDE.—1s. per lb. d/d.
BENZALDEHYDE.—2s. 1½d. per lb. Good home inquiry.
BENZIDINE BASE.—3s. 3d. per lb. 100% basis d/d.
BENZYL CHLORIDE 95%.—1s. 1d. per lb.
p-CHLORPHENOL.—4s. 3d. per lb. d/d.
p-CHLORANILINE.—3s per lb. 100% basis.
o-CRESOL 29/31° C.—3d. per lb. Demand quiet.
m-CRESOL 98/100%.—2s. 1d. to 2s. 3d. per lb. Demand moderate.
p-CRESOL 32/34° C.—2s. 1d. to 2s. 3d. per lb. Demand moderate.
DICHLORANILINE.—2s. 3d. per lb.
DICHLORANILINE S. ACID.—2s. 3d. per lb. 100% basis.
DIETHYLANILINE.—4s. 3d. per lb. d/d., packages extra, returnable.
DIMETHYLANILINE.—2s. per lb. d/d. Drums extra.
DINITROBENZENE.—9d. per lb. naked at works.
DINITROCHLORBENZENE.—£84 per ton d/d.
DINITROPHENOL.—1s. 1d. per lb., 100% basis.
DINITROTOLUENE.—48/50° C. 8d. to 9d. per lb. naked at works. 66/68° C. 10d. per lb. naked at works.
DIPHENYLANILINE.—2s. 10d. per lb. d/d.
G. SALT.—2s. 2d. per lb. 100% basis d/d.
a-NAPHTHOL.—2s. per lb. d/d. Fair home inquiry.
B-NAPHTHOL.—11d. to 1s. per lb. d/d. Fair home inquiry.
a-NAPHTHYLAMINE.—1s. 3d. per lb. d/d. Fair home inquiry.
B-NAPHTHYLAMINE.—3s. 9d. per lb. d/d. Fair home inquiry.
o-NITRANILINE.—5s. 9d. per lb.
m-NITRANILINE.—3s. 6d. per lb. d/d.
p-NITRANILINE.—1s. 9d. to 1s. 10d. per lb. d/d. Fair home inquiry.
NITROBENZENE.—5½d. per lb. naked at works. Good home inquiry.
o-NITROCHLORBENZOL.—2s. 3d. per lb. 100% basis d/d.
NITRONAPHTHALENE.—10d. per lb. d/d.
p-NITROPHENOL.—1s. 9d. per lb. 100% basis d/d.
p-NITRO-*o*-AMIDO-PHENOL.—4s. 6d. per lb. 100% basis.
m-PHENYLENE DIAMINE.—4s. per lb. d/d.
p-PHENYLENE DIAMINE.—9s. 9d. per lb. 100% basis d/d.
R. SALT.—2s. 4d. per lb. 100% basis d/d.
SODIUM NAPHTHIONATE.—1s. 9d. per lb. 100% basis d/d.
o-TOLUIDINE.—9d. per lb. naked at works.
p-TOLUIDINE.—2s. 2d. per lb. naked at works.
m-TOLUYLENE DIAMINE.—4s. per lb. d/d.
m-XYLIDINE ACETATE.—2s. 11d. per lb. 100%.

Wood Distillation Products

ACETATE OF LIME.—Brown, £7 10s. Quiet market. Grey, £15 10s. per ton. Better inquiry. Liquor, 9d. per gall. 32° Tw.
ACETONE.—£81 per ton.
CHARCOAL.—£7 5s. to £9 per ton, according to grade and locality. Demand fair.
IRON LIQUOR.—1s. 6d. per gall. 32° Tw. 1s. 2d. per gall., 24° Tw.
RED LIQUOR.—10d. per gall. 16° Tw.
WOOD CREOSOTE.—2s. 9d. per gall. Unrefined.
WOOD NAPHTHA, MISCIBLE.—3s. 10d. per gall. 60% O.P. Solvent, 4s. 6d. per gall. 40% O.P. Very quiet.
WOOD TAR.—£3 to £4 10s. per ton, according to grade.
BROWN SUGAR OF LEAD.—£42 per ton.

Rubber Chemicals

ANTIMONY SULPHIDE.—Golden, 6d. to 1s. 5d. per lb., according to quality, Crimson, 1s. 3d. to 1s. 7½d. per lb., according to quality.
ARSENIC SULPHIDE, YELLOW.—2s. per lb.
BARYTES.—£3 10s. to £6 15s. per ton, according to quality.
CADMIUM SULPHIDE.—2s. 9d. per lb.
CARBON BISULPHIDE.—£20 to £25 per ton, according to quantity.
CARBON BLACK.—5½d. per lb., ex wharf.
CARBON TETRACHLORIDE.—£50 to £55 per ton, according to quantity, drums extra.
CHROMIUM OXIDE, GREEN.—1s. 2d. per lb.
DIPHENYLGUANIDINE.—3s. 9d. per lb.
INDIARUBBER SUBSTITUTES, WHITE AND DARK.—5½d. to 6¾d. per lb.

LAMP BLACK.—£35 per ton, barrels free.
LEAD HYPOSULPHITE.—9d. per lb.
LITHOPONE, 30%.—£22 10s. per ton.
MINERAL RUBBER "RUBPRON."—£13 12s. 6d. per ton f.o.r. London.
SULPHUR.—£9 to £11 per ton, according to quality.
SULPHUR CHLORIDE.—4d. per lb., carboys extra.
SULPHUR PRECIP. B.P.—£47 10s. to £50 per ton.
THIOCARBAMIDE.—2s. 6d. to 2s. 9d. per lb. carriage paid.
THIOCARBANILIDE.—2s. 1d. to 2s. 3d. per lb.
VERMILION, PALE OR DEEP.—5s. 3d. per lb.
ZINC SULPHIDE.—1s. 1d. per lb.

Pharmaceutical and Photographic Chemicals

ACID, ACETIC, 80% B.P.—£42 per ton ex wharf London in glass containers.
ACID, ACETYL SALICYLIC.—2s. 6d. to 2s. 7d. per lb. Keen competition continuing. Good demand.
ACID, BENZOIC B.P.—2s. to 2s. 3d. per lb., according to quantity.
ACID, BORIC B.P.—Crystal, £46 per ton; Powder, £50 per ton. Carriage paid any station in Great Britain, in ton lots.
ACID, CAMPHORIC.—19s. to 21s. per lb.
ACID, CITRIC.—1s. 4d. per lb., less 5%. Unsettled.
ACID, GALLIC.—2s. 8d. per lb. for pure crystal, in cwt. lots.
ACID, PYROGALLIC, CRYSTALS.—5s. 3d. per lb. Resublimed, 7s. 6d.
ACID, SALICYLIC.—1s. 3d. to 1s. 5d. per lb. Technical.—10½d. to 11d. per lb.
ACID, TANNIC B.P.—2s. 10d. per lb.
ACID, TARTARIC.—1s. 0½d. per lb., less 5%. Market firm.
AMIDOL.—6s. 6d. per lb., d/d.
ACETANILIDE.—1s. 7d. to 1s. 8d. per lb. for quantities.
AMIDOPYRIN.—12s. 6d. per lb.
AMMONIUM BENZOATE.—3s. 3d. to 3s. 6d. per lb., according to quantity.
AMMONIUM CARBONATE B.P.—£37 per ton. Powder, £39 per ton in 5 cwt. casks.
ATROPINE SULPHATE.—11s. per oz. for English make.
BARBITONE.—10s. per lb.
BENZONAPHTHOL.—3s. 3d. per lb. spot.
BISMUTH CARBONATE.—15s. 6d. to 17s. 6d. per lb.
BISMUTH CITRATE.—12s. 9d. to 14s. 9d. per lb.
BISMUTH SALICYLATE.—12s. 6d. to 14s. 6d. per lb.
BISMUTH SUBNITRATE.—13s. to 15s. per lb. according to quantity.
BORAX B.P.—Crystal, £29; Powder, £30 per ton. Carriage paid any station in Great Britain, in ton lots.
BROMIDES.—Potassium, 1s. 9d. to 1s. 11d. per lb.; sodium, 2s. to 2s. 2d. per lb.; ammonium, 2s. 3d. to 2s. 5d. per lb., all spot.
CALCIUM LACTATE.—1s. 4d. to 1s. 6d. Market firmer.
CHLORAL HYDRATE.—3s. 5d. to 3s. 6d. per lb., duty paid.
CHLOROFORM.—2s. 3d. to 2s. 7½d. per lb., according to quantity.
CREOSOTE CARBONATE.—6s. per lb.
FORMALDEHYDE.—£41 per ton, in barrels ex wharf.
GLYCEROPHOSPHATES.—Fair business passing. Calcium, soluble and citrate free, 7s. per lb.; iron, 8s. 9d. per lb.; magnesium, 9s. per lb.; potassium, 50%, 3s. 6d. per lb.; sodium, 60%, 2s. 6d. per lb.
GUAIACOL CARBONATE.—7s. per lb.
HEXAMINE.—2s. 4d. to 2s. 6d. per lb.
HOMATROPINE HYDROBROMIDE.—30s. per oz.
HYDRASTINE HYDROCHLORIDE.—English make offered at 120s. per oz.
HYDROGEN PEROXIDE (12 VOLS.).—1s. 8d. per gallon f.o.r. makers' works, naked.
HYDROQUINONE.—4s. 4¾d. per lb., in cwt. lots.
HYPOPHOSPHITES.—Calcium, 3s. 6d. per lb., for 28-lb. lots; potassium, 4s. 1d. per lb.; sodium, 4s. per lb.
IRON AMMONIUM CITRATE B.P.—2s. to 2s. 3d. per lb. Green, 2s. 4d. to 2s. 9d. per lb. U.S.P., 2s. 1d. to 2s. 4d. per lb.
MAGNESIUM CARBONATE.—Light Commercial, £31 per ton net.
MAGNESIUM OXIDE.—Light Commercial, £67 10s. per ton, less 2½%, price reduced; Heavy Commercial, £23 per ton, less 2½%; Heavy Pure, 2s. to 2s. 3d. per lb., according to quantity.
MENTHOL.—A.B.R. recrystallised B.P., 31s. 6d. net per lb., Synthetic, 17s. 6d. to 22s. 6d. per lb., according to quality. English make.
MERCURIALS.—Red oxide, 5s. 5d. to 5s. 7d. per lb.; Corrosive sublimate, 3s. 9d. to 3s. 11d. per lb.; white precipitate, 4s. 6d. to 4s. 8d. per lb.; Calomel, 4s. to 4s. 2d. per lb.
METHYL SALICYLATE.—1s. 7d. per lb.
METHYL SULPHONAL.—16s. 9d. per lb.
METOL.—9s. per lb. British make.
PARAFORMALDEHYDE.—1s. 11d. for 100% powder.
PARALDEHYDE.—1s. 4d. per lb.
PHENACETIN.—4s. to 4s. 3d. per lb.
PHENAZONE.—6s. to 6s. 3d. per lb. Spot lower than forward price.
PHENOLPHTHALEIN.—4s. to 4s. 3d. per lb. Supply exceeds demand.
POTASSIUM BITARTRATE 99/100% (Cream of Tartar).—80s. per cwt., less 2½% for ton lots. Market very firm.
POTASSIUM CITRATE.—1s. 11d. to 2s. 2d. per lb.
POTASSIUM FERRICYANIDE.—1s. 9d. per lb. in cwt. lots. Quiet.
POTASSIUM IODIDE.—16s. 8d. to 17s. 2d. per lb., according to quantity. Steady market.
POTASSIUM METABISULPHITE.—7½d. per lb., 1-cwt. kegs included, f.o.r. London.
POTASSIUM PERMANGANATE.—B.P. crystals, 7½d. per lb., spot. slightly easier.
QUININE SULPHATE.—2s. 3d. to 2s. 4d. per oz., in 100 oz. tins. Steady market.
RESORCIN.—3s. 9d. per lb. In fair quantities.
SACCHARIN.—51s. 5d. to 53s. 8d. per lb., according to quantity. Limited inquiry.
SALOL.—3s. per lb.
SILVER PROTEINATE.—12s. per lb. for satisfactory product light in colour.
SODIUM BENZOATE, B.P.—1s. 10d. to 2s. 2d. per lb.
SODIUM CITRATE, B.P.C., 1911.—1s. 8d. to 1s. 11d. per lb., B.P.C., 1923. 1s. 11d. to 2s. 2d. per lb., according to quantity.
SODIUM FERROCYANIDE.—4d. per lb. carriage paid.
SODIUM HYPOSULPHITE, PHOTOGRAPHIC.—£14 to £15 per ton, according to quantity, d/d consignee's station in 1-cwt. kegs.
SODIUM METABISULPHITE CRYSTALS.—37s. 6d. to 60s. per cwt., net cash, according to quantity.
SODIUM NITROPRUSSIDE.—16s. per lb.
SODIUM POTASSIUM TARTRATE (ROCHELLE SALT).—75s. to 80s. per cwt., according to quantity.
SODIUM SALICYLATE.—Powder, 1s. 10d. to 2s. per lb. Crystal, 1s. 11d. to 2s. 1d. per lb. Very heavy demand.
SODIUM SULPHIDE, PURE RECRYSTALLISED.—10d. to 1s. 2d. per lb.
SODIUM SULPHITE, ANHYDROUS, £27 10s. to £28 10s. per ton, according to quantity; 1-cwt. kegs included.
SULPHONAL.—12s. per lb. Limited demand.
TARTAR EMETIC, B.P.—Crystal or Powder, 1s. 8d. to 1s. 9d. per lb.
THYMOL.—12s. to 13s. 9d. per lb. Strong demand.

Perfumery Chemicals

ACETOPHENONE.—9s. per lb.
AUBEPINE (EX ANETHOL).—9s. 6d. per lb.
AMYL ACETATE.—3s. per lb.
AMYL BUTYRATE.—6s. 6d. per lb.
AMYL SALICYLATE.—3s. 3d. per lb.
ANETHOL (M.P. 21/22° C.).—5s. 6d. per lb.
BENZYL ACETATE FROM CHLORINE-FREE BENZYL ALCOHOL.—2s. 2d. per lb.
BENZYL ALCOHOL FREE FROM CHLORINE.—2s. 2d. per lb.
BENZALDEHYDE FREE FROM CHLORINE.—2s. 9d. per lb.
BENZYL BENZOATE.—2s. 9d. per lb.
CINNAMIC ALDEHYDE NATURAL.—18s. per lb.
COUMARIN.—11s. 9d. per lb.
CITRONELLOL.—16s. per lb.
CITRAL.—9s. per lb.
ETHYL CINNAMATE.—9s. per lb.
ETHYL PHTHALATE.—3s. per lb.
EUGENOL.—9s. 6d. per lb.
GERANIOL (PALMAROSA).—22s. 6d. per lb.
GERANIOL.—7s. to 16s. per lb.
HELIOTROPINE.—6s. per lb.
ISO EUGENOL.—14s. 6d. per lb.
LINALOL EX BOIS DE ROSE.—18s. per lb.
LINALYL ACETATE.—18s. per lb.
METHYL ANTHRANILATE.—9s. 3d. per lb.
METHYL BENZOATE.—6s. per lb.
MUSK KETONE.—30s. per lb.
MUSK XYLOL.—5s. 9d. per lb.
NEROLIN.—4s. per lb.
PHENYL ETHYL ACETATE.—12s. per lb.
PHENYL ETHYL ALCOHOL.—9s. 6d. per lb.
RHODINOL.—32s. 6d. per lb.
SAFROL.—1s. 4d. per lb.
TERPINEOL.—1s. 6d. per lb.
VANILLIN.—21s. 6d. to 23s. 6d. per lb. Good demand.

Essential Oils

ALMOND OIL.—12s. 6d. per lb.
ANISE OIL.—3s. 7d. per lb.
BERGAMOT OIL.—26s. per lb.
BOURBON GERANIUM OIL.—13s. per lb.
CAMPHOR OIL.—60s. per cwt.
CANANGA OIL, JAVA.—11s. 3d. per lb.
CINNAMON OIL, LEAF.—5d. per oz.
CASSIA OIL, 80/85%.—10s. per lb.
CITRONELLA OIL.—Java, 85/90%, 3s. 6d. Ceylon, 2s. 6d. per lb.
CLOVE OIL.—7s. 3d. per lb.
EUCALYPTUS OIL, 70/75%.—1s. 10d. per lb.
LAVENDER OIL.—French 38/40%, Esters, 24s. per lb.
LEMON OIL.—7s. 9d. per lb.
LEMONGRASS OIL.—4s. 9d. per lb.
ORANGE OIL, SWEET.—11s. 3d. per lb.
OTTO OF ROSE OIL.—Bulgarian, 60s. per oz. Anatolian, 35s. per oz.
PALMA ROSA OIL.—13s. per lb.
PEPPERMINT OIL.—Wayne County, 125s. per lb. Japanese, 16s. 9d. per lb.
PETITGRAIN OIL.—9s. 6d. per lb.
SANDAL WOOD OIL.—Mysore, 26s. per lb. Australian, 18s. 6d. per lb.

London Chemical Market

The following notes on the London Chemical Market are specially supplied to* THE CHEMICAL AGE *by Messrs. R. W. Greeff & Co., Ltd., and Messrs. Chas. Page & Co., Ltd., and may be accepted as representing these firms' independent and impartial opinions.

London, January 22, 1926.

BUSINESS has been fairly satisfactory this week and the volume of business is maintained. Current values are in the main unchanged and prices continue very firm. Export trade continues somewhat on the quiet side, although there is a fair volume of inquiry in evidence.

General Chemicals

ACETONE continues firm and the price is maintained at £81 to £82 per ton.

ACID ACETIC is in good demand without change in value.

ACID FORMIC continues extremely firm, and the price is unchanged at £50 to £51 per ton.

ACID LACTIC is quoted at £43 to £44 per ton for 50 per cent. by weight, with a moderate consumption.

ACID OXALIC is unchanged at 3$\frac{7}{8}$d. to 4d. per lb., demand here is only moderate.

ACID TARTARIC continues quiet and without feature.

ALUMINA SULPHATE continues active, but is without change in value at £5 15s. for 17/18 per cent.

AMMONIUM CHLORIDE is weak and is quoted at £18 per ton.

ARSENIC is, if anything, quieter still, and price is nominally £14 to £15 per ton.

BARIUM CHLORIDE continues firm, and supplies can be obtained at £10 per ton.

BLEACHING POWDER is unchanged at the makers' price of £9 per ton.

CREAM OF TARTAR remains scarce, and supplies can be obtained at round about £76 per ton; the outlook appears to be brighter than has been the case for some time.

EPSOM SALTS continue firm at £5 15s. to £6 per ton.

FORMALDEHYDE is easy, and is quoted at £43 to £44 per ton.

LEAD ACETATE.—Only a moderate demand is reported on this product, and the material is quoted at £44 per ton for white, with £1 reduction for brown.

LIME ACETATE continues extremely firm at £18 to £19 per ton.

LITHOPONE.—Nominally unchanged at £19 to £20 per ton, with a fair demand.

METHYL ALCOHOL is in fair request at £48 per ton.

METHYL ACETONE is a turn firmer at £53 to £55 per ton, and is well called for.

POTASSIUM CARBONATE and CAUSTIC are unchanged.

POTASSIUM CHLORATE is unchanged at 4$\frac{1}{4}$d. to 4$\frac{1}{2}$d. per lb., and has a small demand on export account.

POTASSIUM PERMANGANATE is active, and the market is firm at 7$\frac{3}{4}$d. to 8d. per lb.

POTASSIUM PRUSSIATE is scarce, and the material commands to-day 7$\frac{3}{4}$d. to 8d. per lb.

SODIUM ACETATE is very scarce, and is now quoted at £19 10s. to £20 per ton.

SODIUM BICHROMATE.—Unchanged at British makers' figures.

SODIUM NITRITE is a shade easier, and is quoted at £22 to £22 10s. per ton.

SODIUM PRUSSIATE is very firm, and the material is offered at 4$\frac{1}{2}$d. per lb., with only small supplies available.

SODIUM SULPHIDE is a shade firmer, but is still under the influence of foreign competition.

ZINC SULPHATE is unchanged in value at £14 per ton, with quite a fair business to report.

Coal Tar Products

The market generally maintains a firm tone, with no great change to report in the prices from last week.

90% BENZOL is firm at 1s. 10d. per gallon on rails.

PURE BENZOL is quoted at 2s. 1d. to 2s. 2d. per gallon on rails.

CREOSOTE OIL is unchanged at 6$\frac{1}{4}$d. per gallon on rails in the North, while the price in London is 7$\frac{1}{2}$d. per gallon.

CRESYLIC ACID remains very firm, at 1s. 10d. to 1s. 11d. per gallon on rails for the pale quality 97/99%, while the dark quality 95/97% is quoted at 1s. 6d. to 1s. 7d. per gallon on rails.

SOLVENT NAPHTHA is firm, at 1s. 5$\frac{1}{2}$d. to 1s. 6$\frac{1}{2}$d. per gallon on rails.

HEAVY NAPHTHA is worth about 1s. 2d. per gallon on rails.

NAPHTHALENES are unchanged. The lower grades are worth from £4 to £4 10s. per ton, the 76/78 quality about £6 per ton, and the 74/76 quality about £5 10s. per ton.

PITCH remains firm with good demand, and to-day's values are 60s. to 62s. 6d. per ton f.o.b. main U.K. ports.

Latest Oil Prices

LONDON.—LINSEED OIL closed easier at 5s. to 10s. decline. Spot, £31 15s.; Jan., £30 2s. 6d.; Feb.-April, £30 5s.; May-Aug., £30 7s. 6d.; Sept.-Dec., £30 10s. RAPE OIL quiet. Crude, crushed, spot, £48 10s.; technical refined, £51 10s. COTTON OIL firm. Refined common edible, £42; Egyptian crude, £35; deodorised, £44. TURPENTINE firm and held 3d. to 9d. per cwt. higher. American, spot, 63s.; Feb.-April, 63s. 6d.; and May-June, 63s. 6d.

HULL.—LINSEED OIL.—Spot, £30 15s.; Jan., £30; Feb.-April, £30 12s. 6d.; May-Aug., £30 7s. 6d. COTTON OIL.—Bombay crude, £32; Egyptian crude, £34 10s.; edible refined, £38; technical, £36 10s. PALM KERNEL OIL.—Crushed naked, 5$\frac{1}{2}$ per cent., £43. GROUND-NUT OIL.—Crushed-extracted, £41 15s.; deodorised, £45 15s. SOYA OIL.—Extracted and crushed, £40; deodorised, £43 10s. RAPE OIL.—Extracted and crushed, £47 per ton, net cash terms, ex-mills. CASTOR OIL and COD OIL unchanged.

Nitrogen Products Market

Export.—The floods on the Continent have caused a postponement of the demand for nitrogenous fertilisers and as a consequence sales to Europe have been very small. There has, however, been considerable demand from the Far East. As heavy buying is expected during February/May British producers are holding firm for £12 7s. 6d. per ton, f.o.b. in single bags, with slightly higher prices for March/May shipment.

Home.—The demand for home agricultural use is showing a steady increase, which will be maintained until the height of this season is reached in March. Considerable bookings have been made for March/May delivery. Unless February is a very wet month a heavy season is expected.

Nitrate of Soda.—In Europe the demand for nitrate is very small but this is counteracted to some extent by heavier buying from the United States. The price remains unchanged—cargoes changing hands at about £11 5s. per ton, c.i.f. chief European ports.

U.S. Arsenic Industry Maintained

THE production and sales of arsenic in the United States in 1925 nearly equalled the large output made in 1924, according to the U.S. Bureau of Mines. Four companies that produced white arsenic in the United States in 1925 reported sales which amounted to about 12,000 short tons and sold at from 3 to 6 cents a pound. The quantity sold was nearly equal to the total white arsenic produced. About 8,000 tons was reported in stock at the end of the year. During 1925 about 9,000 tons of white arsenic was imported into the United States. Over 1,000 tons of white arsenic was imported in January and in June; during the other months imports averaged around 750 tons. Most of the imported white arsenic came from Mexico and from ports in Germany and lesser amounts came from Canada, Japan, and Southern Rhodesia. The total available white arsenic in the United States during 1925, therefore, amounted to about 29,000 short tons. Most of it was used in the manufacture of insecticides and for weed killer. Very little calcium arsenate was manufactured for controlling boll weevil during 1925 as the ravages of that pest had far less effect on this year's cotton crop than on previous crops. The manufacturers of week killer used about four pounds of white arsenic to the gallon of solution of which over a million gallons were sold.

The producers of white arsenic in the United States in 1925 were the American Smelting and Refining Company, United States Smelting Refining and Mining Company, Anaconda Copper Mining Company, and the Jardine Mining Company. The price in 1925 ranged from 5$\frac{3}{4}$ cents in January, 4$\frac{3}{4}$ cents in July, 3$\frac{3}{4}$ cents in September and 3$\frac{1}{4}$ cents a pound in December with only an occasional car load being sold.

Esthonian Chemicals for Export

THE Esthonian chemical industry, according to the Esthonian Consul-General in London, is now manufacturing for export sulphuric, nitric, and hydrochloric acids, white lead, nitro-benzole, acetic acid, all kinds of soaps, and cosmetics.

Scottish Chemical Market

The following notes on the Scottish Chemical Market are specially supplied to* THE CHEMICAL AGE *by Messrs. Charles Tennant and Co., Ltd., Glasgow, and may be accepted as representing the firm's independent and impartial opinions.

Glasgow, January 22, 1926.

INQUIRY for heavy chemicals has been very good during the past week, and although quantities asked for have not been very large, the volume of business placed has been better than for some little time.

Prices quoted by home manufacturers and continental merchants show practically no change.

Industrial Chemicals

ACID ACETIC, 98/100%.—Quoted £55 to £67 per ton according to quantity and packing c.i.f. U.K. port; 80% pure, £40 to £41 per ton; 80% technical, £38 to £39 per ton, packed in casks, c.i.f. U.K. ports.

ACID BORIC.—Crystal, granulated, or small flaked, £40 per ton; powdered, £42 per ton, packed in bags, carriage paid U.K. stations.

ACID CARBOLIC, ICE CRYSTALS.—Still in good demand, and now quoted $4\frac{3}{4}$d. per lb., delivered or f.o.b. U.K. port.

ACID CITRIC, B.P. CRYSTALS.—Unchanged at about 1s. $3\frac{3}{8}$d. per lb., less 5%, ex wharf in moderate demand.

ACID FORMIC 85%.—On offer from the continent at about £49 15s. per ton, ex wharf, prompt shipment. Spot material available at about £51 per ton, ex store.

ACID HYDROCHLORIC.—In little demand. Price 6s. 6d. per carboy, ex works.

ACID NITRIC 80°.—Remains unchanged at £23 5s. per ton, ex station, full truck loads.

ACID OXALIC 98/100%.—On offer from the continent at about $3\frac{1}{2}$d. per lb., ex wharf. Spot material still quoted $3\frac{3}{4}$d. per lb., ex store.

ACID SULPHURIC.—144°, £3 12s. 6d. per ton; 168°, £7 per ton, ex works, full truck loads. Dearsenicated quality, 20s. per ton more.

ACID TARTARIC, B.P. CRYSTALS.—Usual steady demand, and price unchanged at about $11\frac{1}{2}$d. per lb., less 5%, ex wharf.

ALUMINA SULPHATE, 17/18% IRON FREE.—On offer from the continent at about £5 10s. per ton, c.i.f. U.K. ports. Spot material available at £6 5s. per ton, ex store.

ALUM, LUMP POTASH.—Rather cheaper quotations from the continent. Now on offer at about £7 15s. per ton, c.i.f. U.K. ports, prompt shipment. Spot material available at about £9 2s. 6d. per ton, ex store. Powdered quality quoted £7 12s. 6d per ton, c.i.f. U.K. ports.

AMMONIA ANHYDROUS.—Now quoted 1s. $3\frac{1}{2}$d. per lb., ex station, containers extra and returnable.

AMMONIA CARBONATE.—Lump, £37 per ton; powdered, £39 per ton; packed in 5 cwt. casks, delivered U.K. ports.

AMMONIA LIQUID 880°.—Unchanged at about $2\frac{1}{2}$d. to 3d. per lb. delivered, according to quantity.

AMMONIA MURIATE.—Grey galvanisers' crystals of British manufacture quoted £26 to £27 per ton, ex station. On offer from the continent at about £22 10s. per ton, c.i.f. U.K. ports. Fine white crystals quoted £18 15s. per ton, c.i.f. U.K. ports, prompt shipment from the continent.

ARSENIC, REFINED WHITE CORNISH.—In little demand, nominally £17 10s. per ton, ex wharf. Spot material available at about £18 15s. per ton, ex store.

BARIUM CHLORIDE.—Large white crystals now quoted £9 10s. per ton, ex store, spot delivery. Continental quotations higher. Large white crystals quoted £8 per ton, c.i.f. U.K. ports. Fine white crystals, £7 15s. per ton. c.i.f. U.K. ports.

BLEACHING POWDER.—English material quoted £9 10s. per ton, ex station. Contracts 20s. per ton less. On offer from the continent at about £7 15s. per ton, c.i.f. U.K. ports.

BARYTES.—English material unchanged at £5 5s. per ton, ex works. Continental quoted £5 per ton, c.i.f. U.K. ports.

BORAX.—Granulated, £24 10s. per ton; crystals, £25 per ton; powdered, £26 per ton, carriage paid U.K. stations.

CALCIUM CHLORIDE.—English manufacturers' price unchanged at £5 12s. 6d. to £5 17s. 6d. per ton, carriage paid U.K. stations. Continental available at about £3 17s. 6d. per ton, ex wharf.

COPPERAS, GREEN.—In moderate demand for export. Now quoted £3 17s. 6d. per ton, f.o.b. U.K. ports.

COPPER SULPHATE.—In good demand for export and price for English material unchanged at £24 per ton, f.o.b. U.K. ports. Continental quoted £22 per ton, ex wharf.

FORMALDEHYDE 40%.—In moderate demand and spot material unchanged at about £40 per ton, ex store. Offered for prompt shipment at £38 per ton, c.i.f. U.K. ports.

GLAUBER SALTS.—English material unchanged at £4 per ton, ex store or station. Continental on offer at about £3 per ton, c.i.f. U.K. ports.

LEAD, RED.—Imported material quoted £42 5s. per ton, ex store.

LEAD, WHITE.—Unchanged at about £42 per ton, ex store, spot delivery.

LEAD ACETATE.—Refined white crystals quoted £41 5s. per ton, c.i.f. U.K. ports, prompt shipment. Spot material on offer at about £44 5s. per ton, ex store.

MAGNESITE, GROUND CALCINED.—In moderate demand and price unchanged at about £8 15s. per ton, ex station.

POTASH CAUSTIC 88/92%.—Syndicate prices vary from £25 10s. to £28 15s. per ton, c.i.f. U.K. ports, according to quantity and destination. Spot material available at about £29 per ton, ex store.

POTASSIUM BICHROMATE.—Unchanged at $4\frac{1}{2}$d. per lb., delivered.

POTASSIUM CARBONATE.—96/98% quality quoted £25 10s. per ton, ex wharf, early delivery. Spot material available at about £26 10s. per ton, ex store; 90/92% quality quoted £22 10s. per ton, c.i.f. U.K. ports.

POTASSIUM CHLORATE 99/100%.—Continental powdered material quoted £29 10s. per ton, c.i.f. U.K. ports. Crystals, about £2 per ton extra.

POTASSIUM NITRATE, SALTPETRE.—Cheaper quotations from the continent. Now quoted about £22 15s. per ton, c.i.f. U.K. ports, prompt shipment. Spot material available at about £25 15s. per ton, ex store.

POTASSIUM PERMANGANATE, B.P. CRYSTALS.—Spot material quoted 8d. per lb., ex store. Offered for early delivery at $7\frac{1}{2}$d. per lb., ex wharf.

POTASSIUM PRUSSIATE, YELLOW.—In good demand and price well maintained at about $7\frac{3}{4}$d. per lb., ex store. Offered for prompt shipment from the Continent at a fraction less.

SODA CAUSTIC.—76/77%, £17 10s. per ton; 70/72%, £16 2s. 6d. per ton; broken, 60%, £16 12s. 6d. per ton; powdered, 98/99%, £20 17s. 6d. per ton. All carriage paid U.K. stations, spot delivery. Contracts 20s. per ton less.

SODIUM ACETATE.—In good demand and spot material scarce. Now quoted £19 per ton, ex store. On offer from the Continent at about £18 10s. per ton, c.i.f. U.K. ports.

SODIUM BICARBONATE.—Refined recrystallised quality £10 10s. per ton, ex quay or station. M.W. quality, 30s. per ton less.

SODIUM BICHROMATE.—English price unchanged at $3\frac{1}{2}$d. per lb. delivered.

SODIUM CARBONATE.—Soda crystals, £5 to £5 5s. per ton ton, ex quay or station; powdered or pea quality, £1 7s. 6d. per ton more; alkali 58, £8 12s. 3d. per ton, ex quay or station.

SODIUM HYPOSULPHITE.—Large crystals of English manufacture quoted £9 per ton, ex station. Minimum 4-ton lots. Pea crystals £14 5s. per ton, ex station. Continental commercial quality offered £9 per ton, ex store.

SODIUM NITRATE.—Quoted £13 per ton, ex store. 95/98% refined quality, 7s. 6d. per ton extra.

SODIUM NITRITE, 100%.—Quoted £24 per ton, ex store. Offered from the Continent about £22 5s. per ton, c.i.f. U.K. ports.

SODIUM PRUSSIATE, YELLOW.—Still in good demand. Quoted $4\frac{3}{8}$d. per lb., ex store. On offer from the Continent at a fraction less.

SODIUM SULPHATE, SALTCAKE.—Price for home consumption, £3 10s. per ton, ex works. Good inquiry for export and higher prices obtainable.

SODIUM SULPHIDE.—60/65% solid, £13 5s. per ton; broken, £14 5s. per ton; flake, £15 5s. per ton; crystals, 31/34%, £8 12s. 6d. per ton. All delivered buyer's works, U.K. minimum 5-ton lots with slight reduction for contracts. 60/62% solid quality offered from the Continent at about £10 10s. per ton, c.i.f. U.K. ports; broken £1 per ton more; crystals, 30/32%, £7 10s. per ton, c.i.f. U.K. port.

SULPHUR.—Flowers, £11; roll, £9 15s.; rock, £9 15s.; ground, £9 10s. Per ton, ex store, spot delivery; prices nominal.

ZINC CHLORIDE.—British material, 95/98%, quoted about £24 per ton, f.o.b. U.K. ports. 98/100% solid on offer from the Continent at about £22 10s. per ton, c.i.f. U.K. ports. Powdered about 20s. per ton extra.

ZINC SULPHATE.—Continental manufacture on offer at about £11 per ton, ex wharf.

NOTE.—The above prices are for bulk business and are not to be taken as applicable to small parcels.

Coal Tar Intermediates and Wood Distillation Products

H. ACID.—3s. 3d. per 100%. Some home inquiries.

PARANITRANILINE.—1s. 9d. per lb. Some home inquiries.

BENZALDEHYDE.—2s. 2d. to 2s. 3d. per lb. Small home inquiries.

SULPHANILIC ACID.—9d. per lb. Good home inquiries.

Manchester Chemical Market

(From Our Own Correspondent.)

Manchester, January 22, 1926.

A steady tone in nearly every line of chemicals has been a marked characteristic of the market here since last report. Here and there, it is true, weakness is apparent, but there has been no further sagging of quotations. In some few instances values are firmer than last week, though this is due more to scarcity of supplies than to any great pressure of demand. There has been a fair amount of inquiry circulating for most of the bread-and-butter lines, with actual business on a quietly steady scale.

Heavy Chemicals

Chlorate of soda meets with a moderate request with values now ranging round 3⅛d. per lb. For hyposulphite of soda the demand is on a restricted scale, though little or no change in values can be recorded ; commercial quality is still in the neighbourhood of £10 per ton, with photographic crystals about £14 5s. Bleaching powder is quoted at £8 10s. per ton, with business of fair dimensions. Saltcake is quiet, as is also glauber salts, but at £3 and £3 5s. per ton respectively quotations are maintained. Sulphide of soda is selling in moderate quantities and prices are steady at £11 10s. to £11 15s. per ton for 60-65 per cent. concentrated solid and £9 10s. for commercial quality. Bicarbonate of soda is still quoted around £10 10s. per ton, with business only on modest lines. Prussiate of soda is firm and in fair request at 4d. to 4¼d. per lb. Inquiry for caustic soda is maintained and values are unchanged at from £15 12s. 6d. per ton for 60 per cent. to £17 10s. for 76 per cent. quality. Alkali is also steady and fairly active at round £6 15s. per ton. The price of acetate of soda is decidedly firm, and round £19 per ton is the average current quotation. A quietly steady demand for soda crystals is being met with at £5 5s. per ton. Bichromate of soda is not a very active seller, though at 3¼d. per lb. values are unaltered. Phosphate of soda is in limited request and prices are easy at £12 to £12 10s. per ton.

Among the potash products caustic is currently quoted at £28 10s. to £29 per ton for 90 per cent. strength, with business on rather quiet lines. Carbonate of potash is steady and is moving in fair quantities ; 96-98 per cent. material is on offer at round £26 per ton. Chlorate of potash is well held at round 4d. per lb., but inquiry is not too brisk. Permanganate of potash is on the quiet side ; commercial material is offering at 5½d. to 5¾d. per lb. and pharmaceutical at 7¼d. to 7½d. per lb. Yellow prussiate of potash is steady and in moderate request at 7⅛d. to 7¼d. per lb. Bichromate of potash is rather slow, though at round 4½d. per lb. values are maintained.

Arsenic has not quotably changed since last report, and white powdered, Cornish makes, is still on offer at about £14 per ton on rails ; the position is said to have improved a little, though demand is still poor. Sulphate of copper attracts little attention at £24 to £24 10s. per ton. Nitrate of lead meets with a moderate amount of inquiry and values keep steady at between £40 and £41 per ton. A similar position exists with regard to white acetate of lead, which is quoted at £44 to £45 per ton, brown material being quoted at £39 to £40. Grey acetate of lime is dearer and in quiet demand at £17 to £17 10s. per ton ; brown is about unchanged at £7 15s. Epsom salts are fairly steady at £3 10s. per ton and magnesium sulphate, pharmaceutical quality, at £4 10s.

Acids and Coal-Tar Products

The acids generally are little changed either in position or value compared with recent weeks. The demand for tartaric acid is restricted at 11¼d. to 11½d. per lb. Citric acid is quiet at about 1s. 3¼d. Oxalic acid is rather slow but unchanged at 3¾d. per lb. Acetic acid is steady and in moderate inquiry at £37 for 80 per cent. commercial and £67 to £68 for glacial.

There is a slightly better tone in the coal-tar products section. Pitch meets with a moderate demand at 55s. to 57s. 6d. per ton, on board at Manchester. Crystal carbolic acid is steadier and rather more active at about 4¾d. per lb., with crude at 1s. 4d. to 1s. 4½d. per gallon. Creosote oil keeps steady at about 6¼d. per gallon, with solvent naphtha quoted at 1s. 5¾d. per gallon. Naphthalene is quiet and about unchanged at £4 5s. per ton and upwards according to quality, with refined at £13 to £14.

Alleged Infringement of Chemical Patent

Acetone and Butyl Alcohol from Grain

The hearing was continued on Monday before Mr. Justice Romer in the Chancery Division of the action by the Commercial Solvents Corporation, Ltd., against the Synthetic Products Co., Ltd. (see The Chemical Age, January 16), for an injunction restraining the alleged infringement of their patented process for the production, by means of a bacillus isolated by Dr. Weizmann, a well-known chemist, of acetone and butyl alcohol from grain.

Sir Arthur Colefax, K.C., and Sir Duncan Kerly, K.C., for the plaintiffs, continued the reading of a large volume of correspondence partly to show, as Sir Arthur said, that Dr. Weizmann, during the time he was associated with Dr. Perkin, now Professor of Chemistry at Oxford, in synthetic rubber experiments, communicated all the results of his experiments in the production of acetone and butyl alcohol to him and to Professor Fernbach and their associates, and kept nothing back. It also showed that the defendant company had never been able to get acetone or the higher alcohols from maize because they never had the bacillus isolated by Dr. Weizmann. Their process was worked by the aid of Professor Fernbach's bacillus on a potato ash.

Mr. Horatio Ballantyne, F.C.S., a distinguished consulting chemist, and a member of the Council of the Institute of Chemistry, gave expert evidence for the plaintiffs. He said he had carried out many tests of cereals and other starch-containing natural products. He dealt with the specification relating to Dr. Weizmann's process, and compared the action of the bacteria with that of the bacteria used in Professor Fernbach's process. He said from his experience a man having Dr. Weizmann's bacillus would have no difficulty in producing acetone and butyl alcohol by the fermentation of maize if he took ordinary precautions in dealing with a new ferment. It was easier to get the two products by working with this bacillus on maize than by means of Professor Fernbach's on potatoes.

Mr. Whitehead, for the defendants, dealing with the prior user issue, said the defendants had since 1910 used several strains of bacteria, isolated in Paris and at Rainham. That known as "X 160" was isolated at Rainham and was used in the fermentation of maize and potatoes, the products of which were sold. With regard to that described as "257," which was said to be an infringement of the plaintiff's patent, it was a lineal descendant of "X 160." The defendants' contention was that "X 160" and "F.B." (Professor Fernbach's bacillus) belonged to the same species.

Dr. Weizmann's Evidence

Dr. Charles Weizmann, in evidence, said he went to Manchester University in 1905 as a research student. He became a demonstrator, and in 1909 graduated as a Doctor of Science. He was at the Pasteur Institute, Paris, in 1909, and met Professor Fernbach there. In 1910 he became associated with Professor Perkin, then Professor of Chemistry at Manchester University, in researches on synthetic rubber production on a commercial scale, and in 1912 he was appointed a senior demonstrator of chemistry in the organic section at Manchester. When the Chair of Bio-Chemistry was created there in 1913 he was appointed the first reader, and he remained there until 1916, when he gave his services to the Government. His association with Professor Perkin ceased in 1912 just after that gentleman had delivered a lecture on synthetic rubber to the Society of Chemical Industry in London.

Continuing his evidence on Thursday, Dr. Weizmann said that up to the time he severed his connection with Professor Perkin he had several times tried to ferment the starch of grain using "F.B." (Professor Fernbach's bacilli). He was present in Paris during part of an important and lengthy experiment in 1912, and coming away before it was completed he thought it promised to be successful. The object of that experiment was the fermentation of the starch of maize with "F.B." Up to the time when the witness patented the process, which was the fruit of his own researches, he did not know that Professor Fernbach had arrived at the conclusion that that experiment had failed. Indeed he was unaware until this litigation that the experiment was not regarded as a success. In reply to questions, Dr. Weizmann declared that he had never intended to publish any confidential information

that he gathered during his connection with Professor Perkin and Professor Fernbach in their researches into the possibility of producing synthetic rubber, nor had he ever threatened to do so. On the termination of his relations with them he considered that he was at liberty to proceed with the study of fermentation processes with the object of obtaining the higher alcohols. At the time he left the two professors in 1912 he had no confidential information about the researches conducted up to then beyond what could be gathered from reading the specifications of the defendants' patented processes. In 1913 he proceeded to study very carefully all the literature possible on the subject of fermentation for the production of alcohols, and this meant very considerable study. It was as the result of his own study and researches that he patented his process. About 1916 he placed his services at the disposal of the Government, who required large quantities of acetone for the manufacture of cordite, and the plant that was set up was the result of collaboration between an engineer at Manchester University and himself. He had, in fact, never seen the defendant's plant at King's Lynn or Rainham, nor did he know anything of it. During the war his process was worked under aerobic conditions strictly, allowing the free access of air, and by the use of "βγ" on the starch of maize large quantities of acetone were produced. The process was still in general use, particularly in the United States. The effect of "βγ" on the starch of maize was to convert the greater part of it into butyl alcohol and acetone, leaving behind no appreciable quantity of organic matter that was fermentable by "βγ."

The hearing was again adjourned.

Chemical Trade Inquiries

The following inquiries, abstracted from the "Board of Trade Journal," have been received at the Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W.1. British firms may obtain the names and addresses of the inquirers by applying to the Department (quoting the reference number and country), except where otherwise stated.

PAINTS, OILS, SODA, ETC.—Paints, oils, soap, soda, disinfectants, lime, Portland cement, for Chatham T.C. Forms from Borough Engineer, returnable by February 4.

TAR.—Tenders are invited for the following supplies of tar, etc. Tenders should be returned by the date shown in parentheses. Dehydrated tar, about 20,000 gallons, specification No. 2, for Bexhill T.C. Forms from Borough Surveyor (February 5); No. 1 tar, 750 tons, for Birmingham Corporation. Forms from City Engineer (February 1). Nos. 1 and 2 tar, 230,000 gallons, for Westmorland C.C. Forms to County Surveyor (February 13). Tar macadam, tar, bituminous spraying compounds and Portland cement, for Halifax B.C. Forms to Borough Engineer (February 13).

OILS, PAINTS, ETC.—Oils, paints, varnishes, lubricating oils, asphalt, bitumen, soap, for Hammersmith B.C. Forms from Town Hall returnable by February 10.

OIL AND COLOURS.—Oil and colours, pitch, creosote oil, Portland cement, grey lime, for Lambeth B.C. Forms from Borough Engineer, returnable by February 11.

MINERAL OILS.—170,000 galls. light mineral oil, 140,000 galls. heavy mineral oil, and 2,500 galls. rapeseed oil, for Corporation of Trinity House, Tower Hill, London. Forms obtainable and returnable by February 4.

SHELLAC, ETC.—A firm in Arnhem desires to represent British firms for the sale of drugs, gelatine, salts, shellac, soap, etc. (Reference No. 97.)

SHELLAC, RAPE OIL, TAR PRODUCTS.—An agent in Copenhagen desires to represent British manufacturers and exporters of the above. (Reference No. 86.)

COLOURS, PAINTS, VARNISHES.—A firm of commission agents in Alexandria wish to represent British manufacturers of the above. (Reference No. 100.)

SALT.—A commission agent in Copenhagen desires to represent British exporters of salt, mainly table salt. (Reference No. 87.)

HEAVY CHEMICALS.—A commission agent of Barcelona wishes to represent British firms exporting heavy chemicals, tannery supplies, textile dressings, and other similar raw materials.

Company News

ROPP TIN CO.—A third interim dividend of 20 per cent. has been declared.

ELLIOTT'S METAL CO.—An interim dividend of 5 per cent. less tax, is announced, payable on February 1.

INTERNATIONAL NICKEL CO.—A quarterly dividend of $1\frac{1}{2}$ per cent. on the preferred stock has been declared payable on February 1.

KEELEY SILVER MINES.—A further dividend of 8 per cent. plus bonus of 4 per cent., making 24 per cent. to date, is announced in respect of the year ending February, 1926.

SHEFFIELD STEEL PRODUCTS.—Report for the year ended May 31 last states that after providing for administration charges and interest on bank loan and prior lien mortgage debenture stock, there remains a balance of £2,094, which has been transferred to depreciation account.

Tariff Changes

NEW ZEALAND.—In regard to the new regulations governing preference to British goods, to be enforced as from April next, the following goods manufactured within such countries in which all the manufacturing processes are performed from unmanufactured raw materials and/or from partly manufactured raw materials, not produced in such countries, shall be eligible for inclusion under the new regulations, where the countries are within the scope of the Tariff:—Argols; abrasives; asbestos, fibre; asphalt, bitumen, tar, and pitch; bromine and iodine; camphor, laurel, crude; carbon-black or gas-black; dyes and vegetable substances used in making dyes; graphite, artificial; gums and resins, refined; magnesite, calcined; metals; oils, essential, natural; oil of turpentine; whale and fish-oils, crude; Chinese wood, palm, olive (crude or refined) oils; potassium, chloride and sulphate of; rubber; sodium nitrate; sugar, unrefined, and molasses; sulphur, in blocks; tanning extracts, vegetable; tanning materials, vegetable; waxes; wood-pulp.

NOTE.—The following are regarded as instances of unmanufactured raw materials for the purposes of these regulations: Natural products such as ores, metallic; petroleum, crude; salt, rock.

GREECE.—The duties on the following goods have been amended until March 31 in accordance with the following table:—

Tariff No.	Article.	Duty in New Tariff.	Co-efficient.	Actual Temporary Duty. per 100 kilogs.
159	Chemical products (without tare deduction for the immediate containers or wrappings):			
	(a) Acids:			
	1. Boric	5	1	5
	3. Sulphuric	2	1	2
	4. Tannic acid or tannin	20	0·4	8
	5. Citric	30	0·25	7·50
	6. Nitric	2	1	2
	7. Oxalic	5	1	5
	8. Pure acetic	10	0·8	8
	9. Ordinary acetic (pyroligneous acid)	2	0	Free
	10. Picric	50	0·15	7·50
	11. Tartaric	30	0·25	7·50
	12. Hydrochloric	2	1	2
	13. Pure phenic	20	0·4	8
	14. Ordinary phenic	2	0	Free
	15. Not specified in the Tariff	10	0·8	8
	(b) 5. Bicarbonate of soda	8	1	8
	(c) 6. Sulphite and bisulphite of potash, soda or calcium	10	0·8	8
	(e) 7. Salts not specified in the Tariff	10	0·8	8
	(g) 19. Chemical products not specified in the Tariff	10	0·8	8
160	(b) Carbide of calcium	20	0·4	8

ESTHONIA.—A commercial treaty between Great Britain and Esthonia was signed on Monday. This provides for most-favoured-nation treatment in customs rates on both sides.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for any errors that may occur.

County Court Judgments

[*NOTE.—The publication of extracts from the " Registry of County Court Judgments " does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for damages or otherwise, and the result of bona-fide contested actions. But the Registry makes no distinction of the cases Judgments are not returned to the Registry if satisfied in the Court books within twenty-one days. When a debtor has made arrangements with his creditors we do not report subsequent County Court judgments against him.*]

BROOKS AND CO., Wolverhampton Street, Dudley, wholesale druggists. (C.C., 23/1/26.) £13 7s. 4d. December 8.

DAVIS, H. A., 5, St. Thomas Street, S.E., druggists' sundryman. (C.C., 23/1/26.) £10 14s. 2d. November 17.

HALL, William, 5, South Street, E.C., disinfectant manufacturer. (C.C., 23/1/26.) £17 16s. 9d. November 20.

RUDDOCK, J., 3, Castle Street, Mansfield Woodhouse, soap manufacturer. (C.C., 23/1/26.) £16 1s. 4d. September 21.

Mortgages and Charges

[*NOTE.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its Annual Summary, specify the total amount of debts due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.*]

ANGLO CONTINENTAL GUANO WORKS, LTD., London, E. (M., 23/1/26.) Registered January 4, trust deed dated December 28, 1925 (supplemental to trust deed dated February 6, 1923, securing £225,000 debenture stock); charged on properties at Hayes, etc. *£149,170. August 15, 1924.

BLEACHERS AND DYERS, LTD., St. Albans. (M., 23/1/26.) Registered January 1, mortgage to bank; charged on Waverley Works, Waverley Road, St. Albans.

HUDDERSFIELD DYERS, LTD. (late STOCKS AND MALLINSON, LTD.). (M., 23/1/26.) Registered December 28, £11,000 (not ex.) debentures to bank; charged on properties in Huddersfield, also general charge; also registered December 28, £21,400 second debentures; general charge. *Nil. June 24, 1925.

London Gazette, &c.

Winding Up Petition

SPEDOL MANUFACTURING CO., LTD. (W.U.P., 23/1/26.) A petition for winding up has been presented by Pilchers, Ltd., and is to be heard at the Royal Courts of Justice, Strand, London, on Tuesday, February 2.

Companies Winding Up Voluntarily

B.D.H. FINE CHEMICAL CO., LTD. (C.W.U.V., 23/1/26.) By special resolution, December 28, confirmed January 12. E. Sibley, 16-30, Graham Street, City Road, N.1, appointed liquidator. Meeting of creditors at liquidator's office, on Monday, February 1, at 11 a.m.

SHEPHERD (M.) AND SONS (GLACERIES), LTD. (C.W.U.V., 23/1/26.) M. Shepherd, 7, Grove Place, Swansea, appointed liquidator, January 11. Meeting of creditors at the company's offices, Rutland Street, Swansea, on Thursday, January 28, at 3 p.m.

Partnership Dissolved

LUTON HAT WORKS (George Henry WRIGHT, Frank Robert OWEN and Percy TAYLOR), dyers and cleaners, hat makers and renovators, Gloucester Road, Croydon, by mutual consent as from January 12, 1926. Debts received and paid by G. H. Wright and F. R. Owen.

Business Names Registered

The following (trading name and address, nature of business, date of commencement, and proprietors' names and addresses) have been registered under the Registration of Business Names Act.

HENDON SCIENTIFIC LABORATORIES, Brent Green Works, Hendon, industrial chemists and engineers, January 7, 1926. Robert Brownlow, Brighton Hall, Cartwright Gardens, W.C.1.

MARINE CHEMICAL CO., Arthur Street Chambers, London Bridge, E., manufacturers and merchants, January 1, 1926. Charlotte E. Kittle, 9, Charles Street Square, North Kensington, and Louisa M. White.

New Companies Registered

BULGARIAN OIL SYNDICATE, LTD. Registered January 12. Producers, refiners, manufacturers, importers and exporters of and dealers in metals, mineral and other oils, etc. Nominal capital, £20,000 in £1 shares. Solicitors: Slaughter and May, 18, Austin Friars, London.

D. SALMOND AND NEPHEW, LTD., The Soap Works, Valley Road, Bradford. Registered January 13. Soap and oil manufacturers, etc. Nominal capital, £16,500 in £1 shares (16,000 preference and 500 ordinary).

WILLIAM L. SHEPHERD AND CO., LTD., 5, Chancery Lane, London. Registered January 14th. Dealers in tar, bitumen, etc.; chemists, analysts, chemical manufacturers and dealers, etc. Nominal capital, £1,000 in £1 shares.

WEST YORKSHIRE OXIDE CO., LTD., Pearl Chambers, East Parade, Leeds. Registered January 15. Chemical manufacturers, paint and pigment manufacturers, etc. Nominal capital, £500 in £1 shares.

Institution of Petroleum Technologists

THE membership of the Institution of Petroleum Technologists is now approximately 800, as compared with 700 a year ago.

The institution is represented on the British Engineering Standards Association, the Imperial Mineral Resources Bureau, the Fuel Economy Committee, the British Association for the Advancement of Science, the Committee of the Birmingham University, which is responsible for the education of Petroleum Technologists, and the American Society for Testing Materials. The institution was also represented on the occasion of the International Congress of Drilling Technologists, Bucarest, from September 26 to October 8, 1925, and the Fifth Congrès de Chimie Industrielle and Commemoration du Centenaire de l'Industrie de la Stearinerie, Paris, from September 27 to October 11, 1925.

The reports on the progress of naphthology during 1924 were published in the August issue of the Journal of the Institution, No. 51; these reports will appear in the Journal each year.

Bitumen for Acid Tank Linings

THE practice of coating acid tanks with bituminous mixtures to promote resistance to corrosive action has been general for some time. but the experience of one concern that has had success in handling this problem is instructive, says *Chemical and Metallurgical Engineering*. Gilsonite, asphalt, coumarin resin, and ordinary resin are used, including usually 20 to 50 per cent. of the resinous constituent. These are melted together in a metal tub, then applied with a broom to the cleaned inner tank surface, leaving a rough coating about $\frac{1}{16}$ in. thick. The seams are usually filled with a special coat of the same or similar material previous to the overall treatment. To an iron pipe, light enough to be readily handled, a flexible connection is made to a gas main. A man working inside the tank, beginning at the top, slowly moves this improvised torch about, flowing the coat on smoothly and evenly. The finished job is said to be decidedly superior to that which can be obtained by means of a swabbing operation only.